Wilson Hall Dance Program Expansion

PROJECT MANUAL

PROJECT NO. 77054

July 30, 2020

ROWAN UNIVERSITY
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ROWAN UNIVERSITY
SECTION II
INSTRUCTIONS TO BIDDERS

1B1. BID PROPOSALS

1B1.1. Sealed proposals for the work described herein must be received and time-stamped at the University's Office of Contracting & Procurement. The closing date and time for bids will be stated in the Advertisement and Invitation for Bid. Bidders are cautioned that reliance on the U.S. Mail for timely delivery of proposals is at the bidder's risk. Failure by the contractor to have sealed proposals reach the University by the prescribed time will result in a return of the submission unopened and unread.

1B1.2. This contract will be bid as a single prime contract only. Bids for less than all of the project as described herein will be deemed nonconforming.

1B1.3. The Instructions to Bidders, Bid forms, Contract forms, plans and specifications, forms of Bid Bond, Agreement of Surety, Performance Bonds, Payment Bonds and other Contract Documents may be examined at the University. Contractors may obtain Contract Documents at the University's Purchasing Website. The University reserves the right to deny award to any bidder who is not clearly responsible based upon experience, past performance and financial capability to perform the work required hereunder or other material factors.

1B1.4. Set(s) of Contract Documents will be available for inspection by interested parties free of charge in Rowan University's Purchasing Department.

1B1.5. Bid proposals based upon the plans, specifications, general, special and supplementary conditions, clarifications and/or addenda shall be deemed as having been made by the contractor will full knowledge of all project conditions. Bidders are strongly encouraged to visit the site prior to submitting proposals for the work herein described and to have thoroughly examined the conditions under which the contract is to be executed including those reasonably observable conditions of the premises which would hinder, delay or otherwise affect the performance of the contractor required under the terms of the contract. The University will not allow claims for additional costs as a result of the contractor's failure to become aware of the reasonably observable conditions affecting his/her required performance. The bidder is required to make appropriate allowances in the preparation of his/her bid for the accommodation of such conditions. Bidders must warrant in the bid documents that the bidder is familiar with conditions existing at the site at the time the bid is submitted.

1B1.6. Bid proposals shall be submitted on the standard form provided by the University, enclosed in a sealed envelope issued by Rowan University. The name and address of the bidder must be indicated on the envelope as well as indication of the project, project location and other appropriate identification.

1B1.7. All amounts in the bid documents shall be stated in numerical figures as well as written out in words. In the event of a contradiction between the numerical and written amounts, the written will control. Any illegible amounts will be deemed non-responsive.

The bidder must include the following items in the bid envelope. Other documents may be required by the University Purchasing Department. Check the University's website for further information on required documents.

a. Bidder's Checklist
b. The Bid Form signed by the bidder
c. Ownership Disclosure
d. The executed Affidavit of Non-collusion;
e. Bid security as further described in Paragraph 1B6;
f. The Acknowledgement of Addenda;
g. Consent of Surety
h. The names and license numbers of and evidence of performance security form of all sub-contractors to who the bidder will sub-contract any of the work on the project for the following:
    1) The plumbing and gas fitting work;
    2) The heating and ventilating systems and equipment;
    3) The electrical work including any electrical power plants;
    4) The structural and ornamental iron work.
    5) Special Categories as may be required.

The remaining documents contained in the complete set of bid forms found after the Table of Contents should be submitted in the bid envelope and shall be required prior to the award of the contract.

1B1.8. Proposals shall remain open for acceptance and may not be withdrawn for a period of sixty (60) days after the bid opening date.

1B1.9. Proposals not submitted and filed in accordance with instructions contained herein and in the Advertisement will be considered informal and rejected as non-responsive.

1B2. BID MODIFICATION

1B2.1. A bidder may modify his/her bid proposal by telegram or letter at any time prior to the scheduled closing time for receipt of bids provided such communication is received by the University prior to such closing time. A written confirmation of any telegraphic modification signed by the bidder must have been mailed and time-stamped by the post office prior to specified closing time. Such confirmation shall be accompanied by a newly executed Affidavit of Non-Collusion.

1B2.2. Telegraphic communications shall not reveal the basic bid price but only shall provide the amount to be added, subtracted or modified so that the final price(s) or term(s) will not be revealed until the sealed proposal is opened. If written confirmation of the telegraphic modification is not received within two (2) working days after the scheduled closing time, no consideration will be given to the telegraphic modification.

1B2.3. Bids may be withdrawn upon written request received from the bidder prior to the time fixed for the bid opening. Right for withdrawal of a bid is lost after a bid has been opened. If any error has been made in the bid amount, request for relief from the bid may be made in writing to the University. The written request shall be signed by an authorized corporate officer. A determination of whether the bidder will be released shall be at the sole discretion of the University who shall issue his/her finding(s) within five (5) days of his/her receipt of all pertinent information relating to such request for relief.

1B3. CONSIDERATION OF BIDS

1B3.1. Award of Projects(s) or Rejection of Bid(s):

a. The Project will be awarded to the lowest responsible bidder whose bid, conforming to the Contract Documents, will be most advantageous to the University. The award will be made or the bid(s) rejected within sixty (60) days from the date of the opening of the bids.
b. All bid security deposits of unsuccessful bidders, except the lowest three (3) bidders, will be returned or refunded within five (5) days of the bid opening.
c. The bid security deposits of the successful bidder and the next two (2) lowest bidders will be retained by the University until the execution and delivery of a formal contract and delivery of performance and payment bonds by the bidder awarded the project. At such time, bid deposits of the other two (2) low bidders will be returned.
d. The University reserves the right to award the project on the basis of the single bid for the entire work on or the basis of a separate bid and alternate, or any combination of separate bids and alternates, which the University deems best serves the interest of the University.
e. The University reserves the right to waive, in its sole discretion, minor informalities or non-material exceptions in the bid when such waiver is in the best interests of the University and where such waiver is permitted by law.
f. The University reserves the right to reject any and all bids when such rejection is in the best interests of the University and is permitted by law. The University may also reject the bid of any bidder who, in its judgement, is not responsible or capable of performing the project based on financial capability, past performance or experience. A bidder whose bid is so rejected may request a hearing before the University by filing a written notice within seven (7) days of the transmittal of the rejection.

1B3.2. The bidder to whom the project is awarded shall execute and deliver the requisite Contract Documents including payment and performance bonds within the time specified. Upon his/her failure or refusal to comply in the manner and within the time specified, the University may either award the contract to the next low, responsible bidder or re-advertise for new proposals. In either case, the University may hold the defaulting bidder and his/her surety liable for the difference between the applicable sums quoted by the defaulting bidder and that sum which the University may be obligated to pay to the contractor who undertakes to perform and complete the work of the defaulting bidder.

1B4. AWARDS

1B4.1. In executing a contract, the successful bidder agrees to perform his/her work in a good and workmanlike manner and to complete portions of the work by established milestone dates and all work within the number of calendar days specified in his/her contract.

1B4.2. The successful bidder will be notified of the time and place for the signing of the contract. Key requirements in the conduct of the contract include, but are not limited to, project milestones, the number of days for performance of the contract, manner and schedule of payments, site logistics and other administrative details will be reviewed at the award meeting. The time and place of the first job meeting will also be announced.

1B4.3. The project shall be awarded to the lowest responsible bidder whose bid, conforming to the Bidding Documents, will be the most advantageous to the University. Alternates will be accepted or rejected as selected by the University. Add alternates and deduct alternates will be specified separately. The University may choose from the add and deduct alternates without priority between the two groups. The University may accept alternates out of sequence provided it states its reasons for so doing.

1B4.4. Should submission of unit prices be required for specific items of work in bid proposals, they will be considered in the evaluation of bids.

1B4.5. LIQUIDATED DAMAGES ARE PART OF THIS PROJECT. Please refer to Section 017700 Contract Closeout in the Project Manual.

1B4.6. PLEASE NOTE THAT THE SUCCESSFUL BIDDER SHALL BE REQUIRED TO ENTER INTO **MODIFIED** AIA A101-2017 CONTRACT FOR CONSTRUCTION AND THE AIA A201-2017, BOTH OF WHICH ARE ATTACHED AS PART OF THIS BID PACKAGE.

1B5. QUALIFICATIONS OF BIDDERS

1B5.1. If the successful bidder is a corporation not organized under the laws of the State of New Jersey, or is not authorized to do business in this state, the award of the project shall be conditioned upon the prompt filing by the said corporation of a certificate to do business in this state and shall comply with the laws of this state in that regard. This filing must be made within the Division of Revenue and Enterprise Services. No award of project will be made until the Department of State confirms this authorization.

1B5.2. The University requires that each contractor shall perform a minimum of thirty-five percent (35%) of the contract work by his/her own forces. The University, however, may, in its sole discretion, reduce this percentage depending upon the nature and circumstances in any particular case if it determines that to do so would be in the best interests of the University provided that a written request is submitted to it prior to the bid opening.

1B5.3. The University reserves the right to reject a bid at any time prior to the signing of a contract if information or data is obtained which, in the opinion of the University, adversely affects the responsibility and/or the capability of the bidder to undertake and to complete the work regardless of the bidder's previous qualification or classification. The University may conduct any investigation as it deems necessary to determine the bidder's responsibility and capacity and the bidder shall furnish all information and data for this purpose as the University may request.

1B5.4. The bidder shall include a list of the sub-contractors to whom the bidder will sub-contract work with his/her bid for:

a. the plumbing and gas fitting work;
b. the heating and ventilating systems and equipment;
c. the electrical work including any electrical power plants;
d. the structural and ornamental iron work; and
e. special categories as may be required.

1B6. DEPOSIT AND BID BOND

1B6.1. Each proposal shall be accompanied by a bid bond or by a certified or cashier's check made payable to the University equal to ten percent (10%) of the amount of the proposal as evidence of good faith which guarantees that, if the proposal submitted by the bidder is accepted, the bidder will enter into the contract and furnish the required Contract Documents and surety bonds. If a bid bond is submitted, it shall also provide that the surety issuing the bid bond be bound to issue the required payment and performance bonds if the bidder is awarded the project. If the bidder whose proposal is accepted is unable to provide the performance and payment bonds or fails to execute a contract, then such bidder and the bid bond surety shall be obligated to pay to the University the difference between the amount of the bid and the amount which the University contracts to pay another party to perform the work. The University reserves the right to retain any certified or cashier's check deposited hereunder as reimbursement for the difference as aforesaid and shall return any non-required balance to the bidder. Should there be a deficiency in the excess of the bid deposit, the bidder and the surety shall pay the entire amount of the University's difference in cost upon demand. Nothing contained herein shall be construed as reason of a default or breach by the contractor. Certified or cashier's checks or bonds submitted by the unsuccessful bidders will be returned after the contract has been executed. Contractors electing to furnish a bid bond must include consent of surety, both in form acceptable to the University.

1B6.2. Attorneys-in-fact who sign bid bonds or contract bonds must file a certified power of attorney with the University indicating the effective date of that power.

1B7. PERFORMANCE AND PAYMENT BONDS

1B7.1. Within five (5) calendar days, the successful bidder shall furnish a performance bond in statutory form (N.J.S.A. 2A:44-147) in an amount equal to one hundred percent (100%) of the total contract price as security for the faithful performance of this contract and also a payment bond in statutory form in an amount equal to one hundred percent (100%) of the contract price as security for the payment of all persons and firms performing labor and furnishing materials in connection with this contract. The performance and payment bond may be in one or in separate instruments in accordance with the law. No contract shall be executed unless and until each bond is submitted to and approved by the University and the surety must be presently authorized to do business in the State of New Jersey. The surety's obligation shall continue beyond final acceptance to the extent that the contractor would have such an obligation.

1B7.2. The cost of bonds shall be paid for by the contractor.

1B7.3. At any time, if the University is dissatisfied with any surety or sureties, who have issued or proposed to issue, the performance or payment bonds for justifiable cause, the contractor shall substitute an acceptable bond or bonds in such form and sum and executed by such other surety or sureties as may be satisfactory to the University within ten (10) days after notice from the University to do so. The premiums of such bonds shall be paid by the contractor. No contract shall be executed and/or no payment made under a contract until the new surety or sureties shall have furnished such an acceptance bond to the University.

1B7.4. Bonds must be legally effective as of the date the contract is signed. Bonds must indicate contractor's names exactly as they appear on the contract. Current attorney-in-fact instruments and financial statement of the surety must be included with the bond. Bonds must be executed by an authorized officer of the surety. Bonds furnished under this article shall conform in all respects to the requirements and language of N.J.S.A. 2A:44-143 to 147.

1B8. BULLETINS AND INTERPRETATIONS

1B8.1. No interpretation of the meaning of the plans, specifications or other pre- bid documents will be provided to any bidder unless such interpretation is made in writing to all prospective bidders prior to the bid opening. Any such interpretations must be identified in bid proposals submitted. Any interpretations which are not entered in accordance with this provision shall be unauthorized and not binding upon the University.

1B8.2. Every request for an interpretation relating to clarification or correction of the plans, specifications or other bid documents shall be made in writing addressed to the University and must be received at least five (5) working days prior to the date fixed for the bid opening. Any and all interpretations, clarifications or corrections and any supplemental instructions must be issued by the University in writing in the form of bulletins and mailed by certified mail, return receipt requested or by telegraphic notice to all prospective bidders no later than three (3) working days prior to the date of the bid opening. All bulletins issued shall become part of the Contract Documents and shall be acknowledged in all the bid proposals. Failure of a contractor to acknowledge receipt of all such bulletins and interpretations by the time of the bid opening shall result in his/her proposal being considered non-responsive at the option of the University.

1B8.3. Each bidder shall be responsible for thoroughly reviewing the Contract Documents prior to submission of bids. Bidders are advised that no claim for expenses incurred or damage sustained on account of any error, discrepancy, omission or conflict in their bid submission will be entertained. Documents shall be recognized by the University unless, and only to the extent that, a written request for interpretation, clarification or correction has been submitted in compliance with section 1B8.2 and the matter has not been addressed by the University through the issuance of a bulletin interpreting, clarifying and/or correcting such error, discrepancy, omission or conflict.

1B9. ASSIGNMENTS

1B9.1. The contractor shall not assign the whole or any part of this contract without prior written consent of the University. Money due or to become due to the contractor hereunder shall not be assigned for any purposes whatsoever.

1B10. FEDERAL EXCISE TAXES AND STATE SALES TAX

1B10.1. In general, bidders must take into consideration applicable Federal and state tax laws when preparing their bids.

1B10.2. Under Chapter 32 of the Internal Revenue Code, an exemption certificate must be on file with the University of the Division of Purchasing. (example, Number 22-75-005)

1B10.3. Materials, supplies or services for exclusive use in erecting structures or buildings or otherwise improving, altering or requiring all University-owned property are exempt from the State sales tax.

1B10.4. Bidders must make their own determinations as to the current status and applicability of any tax laws and the contractor may make no claim based upon any error or misunderstanding as to the applicability of any tax laws.

1B10.5. Purchases or rentals of equipment are not exempt from any tax under the State Sales Tax Act.

1B11. RESTRICTIVE SPECIFICATIONS

1B11.1. Should any bidder determine before the bid due date that any portion of the specifications or drawings specify a particular product which can be provided by one (1) supplier or manufacturer with the result that competitive prices are not available, he/she shall immediately notify the University and Construction Manager of the fact in writing.

1B11.2. If such notice is not given in a timely manner, it shall be assumed that the bidder has included the estimate of such sole source in his/her bid. In the alternative, if the University and Construction Manager are notified in a timely manner of the requirement in the specification of a sole source of supply or manufacture, the University may order the project rebid or may take any other lawful action.

1B12. OFFER OF GRATUITIES

1B12.1. (a)Chapter 48 of the laws of 1954 make it a misdemeanor to offer, pay or give any fee, commission, compensation, gift or gratuity to any person employed by the State. It is the policy of the University to treat the offer of any gift or gratuity by any company, its officers or employees to any person employed by Rowan University as grounds for debarment or suspension of such company from bidding on and providing work or materials on University contracts. No vendor shall pay, offer to pay, or agree to pay, either directly or indirectly, any fee, commission, compensation, gift, gratuity, or other thing of value of any kind to any State officer or employee or special State officer or employee, as defined by N.J.S.A. 52:13D-13b. and e., in the Department of the Treasury or any other agency with which such vendor transacts or offers or proposes to transact business, or to any member of the immediate family, as defined by N.J.S.A. 52:13D-13i., of any such officer or employee, or any partnership, firm, or corporation with which they are employed or associated, or in which such officer or employee has an interest within the meaning of N.J.S.A. 52:13D-13g.

b. The solicitation of any fee, commission, compensation, gift, gratuity or other thing of value by any State officer or employee or special State officer or employee from any State vendor shall be reported in writing forthwith by the vendor to the Attorney General and the Executive Commission on Ethical Standards.

c. No vendor may, directly or indirectly, undertake any private business, commercial or entrepreneurial relationship with, whether or not pursuant to employment, contract or other agreement, express or implied, or sell any interest in such vendor to, any State officer or employee or special State officer or employee having any duties or responsibilities in connection with the purchase, acquisition or sale of any property or services by or to any State agency or any instrumentality thereof, or with any person, firm or entity with which he is employed or associated or in which he has an interest within the meaning of N.J.S.A. 52:13D-13g. Any relationships subject to this provision shall be reported in writing forthwith to the Executive Commission on Ethical Standards, which may grant a waiver of this restriction upon application of the State officer or employee or special State officer or employee upon a finding that the present or proposed relationship does not present the potential, actuality or appearance of a conflict of interest.

d. No vendor shall influence, or attempt to influence or cause to be influenced, any State officer or employee or special State officer or employee in his official capacity in any manner which might tend to impair the objectivity or independence of judgment of said officer or employee.

e. No vendor shall cause or influence, or attempt to cause or influence, any State officer or employee or special State officer or employee to use, or attempt to use, his official position to secure unwarranted privileges or advantages for the vendor or any other person.

f. The provisions cited above in paragraph a. through e shall not be construed to prohibit a State officer or employee or special State officer or employee from receiving gifts from or contracting with vendors under the same terms and conditions as are offered or made available to members of the general public subject to any guidelines the Executive Commission on Ethical Standards may promulgate under paragraph 3c.

1B.13 ANTIDISCRIMINATION

1B.13.1 Pursuant to N.J.S.A. 10:2-1 The contractor agrees that:

a. In the hiring of persons for the performance of work under this contract or any subcontract hereunder, or for the procurement, manufacture, assembling or furnishing of any such materials, equipment, supplies or services to be acquired under this contract, no contractor, nor any person acting on behalf of such contractor or subcontractor, shall, by reason of race, creed, color, national origin, ancestry, marital status, gender identity or expression, affectional or sexual orientation or sex, discriminate against any person who is qualified and available to perform the work to which the employment relates;

b. No contractor, subcontractor, nor any person on his behalf shall, in any manner, discriminate against or intimidate any employee engaged in the performance of work under this contract or any subcontract hereunder, or engaged in the procurement, manufacture, assembling or furnishing of any such materials, equipment, supplies or services to be acquired under such contract, on account of race, creed, color, national origin, ancestry, marital status, gender identity or expression, affectional or sexual orientation or sex;

c. There may be deducted from the amount payable to the contractor by the contracting public agency, under this contract, a penalty of $ 50.00 for each person for each calendar day during which such person is discriminated against or intimidated in violation of the provisions of the contract; and

d. This contract may be canceled or terminated by the contracting public agency, and all money due or to become due hereunder may be forfeited, for any violation of this section of the contract occurring after notice to the contractor from the contracting public agency of any prior violation of this section of the contract.

1.B.14 EQUAL PAY

1B.14.1. Pursuant to N.J.S.A. 34:11-56.14(b), any employer, regardless of the location of the employer, who enters into a contract with a public body to perform any public work for the public body shall provide to the Commissioner of the New Jersey Department of Labor and Workforce Development, through certified payroll records required pursuant to N.J.S.A. 34:11-56.25 et seq., information regarding the gender, race, job title, occupational category, and rate of total compensation of every employee of the employer employed in the State in connection with the contract. The employer shall provide the Commissioner, throughout the duration of the contract or contracts, with an update to the information whenever payroll records are required to be submitted pursuant to N.J.S.A. 34:11-56.25 et seq.

END OF SECTION I

DRAFT

AIA® Document A201™ – 2017

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)

Bunce Hall Renovations

THE OWNER:
(Name, legal status and address)

Rowan University
201 Mullica Hill Road
Glassboro, NJ 08028

THE ARCHITECT:
(Name, legal status and address)

KSS Architects, LLP
337 Witherspoon Street
Princeton, New Jersey 08542

TABLE OF ARTICLES

ADDITIONS AND DELETIONS: The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.

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(Topics and numbers in bold are Section headings.)

ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, the Contractor's Bid, Bid Solicitation other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. The Contract Documents shall include the Requirements as outlined specifically in the Bid Solicitation.

§ 1.1.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants, or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§1.1.2.1 The Contractor acknowledges and warrants that it has closely examined all of the Contract Documents, that they are suitable and sufficient to enable the Contractor to complete the Work in a timely manner for the Contract Sum, and that they include all Work, whether or not shown or described, which reasonably may be inferred to be required or useful for the completion of the Work in full compliance with all applicable codes, laws, ordinances and regulations and that questions regarding the bid documents and any interpretation(s) regarding same have been asked by the contractor, in the form and manner required in the instructions to bidders.

§ 1.1.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§1.1.3.2 Nothing in these General Conditions shall be interpreted as imposing on the Owner, or its respective agents, employees, officers, directors or consultants, any duty, obligation or authority with respect to any items that are not intended to be incorporated into the completed project, including but not limited to shoring, scaffolding, hoists, temporary weatherproofing, or any temporary facility or temporary activity, since these are the sole responsibility of the Contractor.

§ 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

§ 1.1.5 The Drawings

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.6 The Specifications

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 Instruments of Service

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 Initial Decision Maker

The Initial Decision Maker is the Architect. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 Interpretation

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

§ 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

§ 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

§ 1.9 EXECUTION OF CONTRACT DOCUMENTS

§ 1.9.1 The Contract Documents shall be signed by the Owner and Contractor. The Agreement shall be signed in not less than quadruplicate by the Owner and Contractor.

§ 1.9.2 Execution of the Contract by the Contractor is a representation that said Contract Documents are full and complete, are sufficient to have enabled the Contractor to determine the cost of the Work therein to enter into the Contract and that the Contract Documents are sufficient to enable it to perform the Work outlined therein, and otherwise to fulfill all its obligations hereunder, including, but not limited to, Contractor's obligation to perform the Work for an amount not in excess of the Contract Sum on or before the date(s) of Substantial Completion established in the Agreement. The Contractor further acknowledges and declares that it has visited and examined the site, examined all physical, legal, and other conditions affecting the Work and is fully familiar with all of the conditions thereon and thereunder affecting the same. In connection with the foregoing, and having carefully examined all Contract Documents, as aforesaid, and having visited the site, the contractor acknowledges and declares that it has no knowledge of any discrepancies, omissions, ambiguities, or conflicts in said Contract Documents and that if it becomes aware of any such discrepancies, omissions, ambiguities, or conflicts, it will promptly notify Owner and Engineer of such fact.

1.9.3. The term "reasonably inferable" includes work necessary to "provide" work indicated or specified, as defined in section: Definitions and Standards; that is: furnish and install, complete, in place and ready for use.

1.9.3.1 Details referenced to portions of the Work shall apply to other like portions of the Work not otherwise detailed.

1.9.3.2 The Contractor shall request, from the Owner interpretation of apparent discrepancies, conflicts, or omissions in the Specifications and Drawings. Subcontractors shall forward such requests through the Contractor. Such requests, and the Engineer's interpretation, shall be in written form; other forms of communications shall be used to expedite resolution of concerns, but will not be binding.

§1.9.4 Explanatory notes shall take precedence over conflicting drawn note indications. Large scale drawings shall take precedence over small scale drawings. Figured dimensions shall take precedence over scaled measurements. Should contradictions be found, the Engineer shall determine which indication is correct.

§1.9.5 Where it is required in the specifications that materials, products, processes, equipment, or the like be installed or applied in accordance with manufacturers' instructions, directions, or specifications, or words to this effect, it shall be construed to mean that said application or installation shall be in strict accordance with printed material concerned for use under conditions similar to those at the job site. Three copies of such instructions shall be furnished to the Engineer and his written approval thereof obtained before work is begun.

§1.9.6 Any material specified by reference to the number, symbol, or title of a Commercial Standard, Federal Specification, ASTM Specification, trade association standard, or other similar standards, shall comply with the requirements in the latest revision thereof and any amendments or supplements thereto in effect one month prior to the date on which bids are opened and read, except as limited to type, class, or grade, or modified in such reference. The standards referred to, except as modified in the specifications, shall have full force and effect as though printed in the specifications. The Engineer will furnish upon request information as to how copies of the standards referred to may be obtained.

§ 1.8 The word "contractor" shall mean the prime contractor(s) with whom the contract has been executed.

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative. Contractor understands and acknowledges that the authority for all decisions required to be made resides with Owner. Architect and/or Contractor shall not rely upon or request from owner's Representatives any decision which requires Owner's determination

§ 2.2 *Intentionally Omitted.*

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.3.2 Intentionally Omitted.

§ 2.3.3 Intentionally Omitted.

§ 2.3.4 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The furnishing of these surveys and the legal description of the site shall not relieve the Contractor from its duties under the Contract Documents. Neither Owner nor the Engineer shall be required to furnish Contractor with any information concerning subsurface characteristics or conditions of the areas where the Work is to be performed. When the Owner or Engineer has made investigations of subsurface characteristics or conditions of the areas where the Work is to be performed, such investigations, if any, were made solely for the purposes of Owner's study. Neither such investigations nor the records thereof are a part of the Contract between Owner and Contractor. To the extent such investigations or the records thereof are made available to Contractor by the Owner or Engineer, such information is furnished solely for the convenience of Contractor. Neither Owner nor Engineer assumes any responsibility whatsoever in respect of the sufficiency or accuracy of the investigations thus made, the records thereof, or of the interpretations set forth therein or made by the Owner or Engineer in its use thereof, and there is no warranty or guaranty, either express or implied, that the conditions indicated by such investigations or records thereof are representative of those existing throughout the areas where the Work is to be performed, or any part thereof, or that unforeseen developments may not occur, or that materials other than or in proportions different from those indicated may not be encountered. The Contractor shall undertake such further investigations and studies as may be necessary or useful to determine subsurface characteristics and conditions. In connection with the foregoing, Contractor shall be solely responsible for locating (and shall locate prior to performing any Work) all utility lines, telephone company lines and cables, sewer lines, water pipes, gas lines, electrical lines, including, without limitation, all buried pipelines and buried telephone cables and shall perform the Work in such a manner so as to avoid damaging any such lines, cables, pipes, and pipelines.

§ 2.3.5 Intentionally Omitted.

§ 2.3.6 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

§ 2.4 Owner's Right to Stop the Work

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, or fails or refuses to provide a sufficient amount of properly supervised and coordinated labor, materials, or equipment so as to be able to complete the Work within the Contract Time or fails to remove and discharge (within ten days) any lien filed upon Owner's property by anyone claiming by, through, or under Contractor, or disregards the instructions of Architect or Owner when based on the requirements of the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity.

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

ARTICLE 3 CONTRACTOR

§ 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. In addition to Contractor's duties under this Agreement, the Contractor shall carefully study and compare the Contract Documents with each other and shall at once report to the Owner errors, inconsistencies or omissions discovered. If the Contractor performs any construction activity involving an error, inconsistency or omission in the Contract Documents that the Contractor recognized or reasonably should have recognized without such notice to the Owner, the Contractor shall assume complete responsibility for such performance and shall bear the full amount of the attributable costs for correction. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities; unless the Contractor recognized such error, inconsistency, omission or difference and knowingly failed to report it to the Owner.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.3.4 Contractor shall be solely responsible for the means and methods of the work performed. Owner shall have no obligation, responsibility and/or liability with respect to any issues, claims or controversies arising out of the manner in which work is performed, nor shall the Owner be responsible and/or liable for any issue, claim or controversy arising out of Contractor's failure to operate consistent with OSHA or other safety standards.

§ 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

§ 3.6 Taxes

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to the correction thereof or related thereto, including all fines and penalties.

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- **.1** allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- **.3** whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a full time competent superintendent, acceptable to the Owner, and necessary assistants who shall be in attendance at the Project site during performance of the Work and until final completion of all work, including all corrective and punch list items. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 Shop Drawings, Product Data and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design

professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

§ 3.13 Use of Site

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.13.1 Location and weights of all equipment and materials and the Contractor intends to place on the site shall be submitted to the Owner for review.

§ 3.13.2 Only materials and equipment which are to be used directly in the Work shall be brought to and stored on the Project site by the Contractor. After equipment is no longer required for the Work, it shall be promptly removed from the Project site. Protection of construction materials and equipment stored at the Project site from weather, theft, damage and all other adversity is solely the responsibility of the Contractor.

§ 3.13.3 The Contractor and any entity for whom the Contractor is responsible shall not erect any sign on the Project site without the prior written consent of the Owner with the exception of those directed to be erected through the contract documents and those necessary for site safety or in an emergency.

§ 3.13.4 Contractor shall ensure that the Work, at all times, is performed in a manner that affords reasonable access, both vehicular and pedestrian, to the site of the Work and all adjacent areas. The Work shall be performed, to the fullest extent reasonably possible, in such a manner that public areas adjacent to the site of the Work shall be free from all debris, building materials and equipment likely to cause hazardous conditions. Without limitation of any provision of the Contract Documents, Contractor shall use its best efforts to minimize any interference with the occupancy or beneficial use of (1) any areas and buildings adjacent to the site of the Work.

§ 3.13.5 Without prior approval of the Owner, the Contractor shall not permit any workers to use any existing facilities at the Project site, including without limitation, lavatories, toilets, entrances and parking areas other than those designated by the Owner. Without limitation of any other provision of the Contract Documents, the Contractor shall use its best efforts to comply with all rules and regulations promulgated by the Owner in connection with the use and occupancy of the Project site and the Building, as amended from time to time.

The Contractor shall immediately notify the Owner in writing if during the performance of the Work, the Contractor finds compliance with any portion of such rules and regulations to be impracticable, setting forth the problems of such and suggest alternatives through which the same results can be achieved. The Owner may, in the Owner's sole discretion, adopt such suggestions, develop new alternatives or require compliance with the existing requirement of the rules and regulations. The Contractor shall also comply with all insurance requirements and collective bargaining agreements applicable to use and occupancy of the Project site and the Building.

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor

except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 Access to Work

The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located.

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

§ 3.18 Indemnification

§ 3.18.1

§ 3.18.1To the fullest extent permitted by law the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and their respective agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Section 3.18.

.1 Contractor, for itself, its successors and assigns, agrees to indemnify and save Owner, the individual members (past, present and future), its successors, assigns, employees, agent, Engineers, and/or the harmless from, and against any and all claims, demands, damages, actions or causes of action by any party, together with any and all losses, costs or expenses in connection therewith or related thereto, including, but not limited to, attorney fees and costs of suit, for bodily injuries, death or property damage arising in or in any manner growing out of the work performed, or to be performed under this Contract. Contractor and its successors and assigns agree to indemnify the Owner, its individual members (past, present and future), its successors, assigns, employees, agents, and Engineers and against all fines, penalties or losses incurred for, including, but not limited to, attorney fees and costs of suit, or by reason of the violation by Contractor in the performance of this Contract, or any ordinance, regulation, rule of law of any political subdivision or duly constituted public authority. Without limiting the foregoing, the Contractor, at the request of Owner, its individual members (past and present), its successors, assigns, employees, agents, or Engineers, agrees to defend at the Contractor's expense any suit or proceeding brought against Owner, its individual members (past, present and future), its successors, assigns, employees, agents, Engineers due to, or arising out of the work performed by the Contractor.

.2 The Contractor assumes the entire risk, responsibility, and liability for any and all damage or injury of every kind and nature whatsoever (including death resulting therefrom) to all persons, whether employees

of the Contractor or otherwise, and to all property (including the Work itself) caused by, resulting from, arising out of or occurring in connection with the execution of the Work, or in preparation for the Work, or any extension, modification, or amendment to the Work by the Change Order or otherwise. To the fullest extent permitted by law, the Contractor and its Surety shall indemnify and save harmless the Owner, the Architect, the Architect's consultants, and the respective agents and employees of any of them (herein collectively called the Indemnitees) from and against any and all liability, loss, damages, interest, judgments, and liens growing out of, and any and all costs and expenses (including, but not limited to, counsel fees and disbursements) arising out of, relating to or incurred in connection with the Work including, any and all claims, demands, suits, actions, or proceedings which may be made or brought against any of the Indemnitees for or in relation to any breach of the Contract for Construction or any violation of the laws, statutes, ordinances, rules, regulations, or executive orders relating to or in any way affecting the performance or breach of the Contract for Construction, whether or not such injuries to persons or damages to property are due or claimed to be due, in whole or in part, to any negligence of the Contractor or its employees, agents, subcontractors, or materialmen, excepting only such injuries and/or damages as are the result of the sole gross negligence of the Owner or Architect.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

ARTICLE 4 ARCHITECT

§ 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

§ 4.1.2 Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner, Contractor, and Architect. Consent shall not be unreasonably withheld.

§ 4.2 Administration of the Contract

§ 4.2.1 The Owner will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

.1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and

.2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

7.1.1.1 A field directive or field order shall not be recognized as having any impact upon the Contract Sum or the Contract Time and the Contractor shall have no claim therefor unless it shall, prior to complying with same and in no event no later than 10 working days from the date such direction or order was given, submit in writing to the Owner for the Owner's approval its change proposal.

7.1.1.2 When submitting its change proposal, the Contractor shall include and set forth in clear and precise detail breakdowns of labor and materials for all trades involved and the estimated impact on the construction schedule. The Contractor shall furnish spread sheets from which the breakdowns were prepared, plus spread sheets if requested of any Subcontractors.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.2.1 Neither this Contract nor the Work to be performed hereunder can be changed by oral agreement. No course of conduct or dealings between the parties, nor express or implied acceptance of alterations or additions to the Work and no claims that the Owner has been unjustly enriched by any alteration or addition to the Work, whether there is, in fact, any unjust enrichment to the Work, shall be the basis for any alleged implied agreement by the Owner to the change, any alleged waiver of the Owner's right under this Contract or any increase in any amounts due under the Contract or any or a change in any time period provided for in the Contract Documents.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.1.4 A directive or order from the owner or the Engineer, other than a change order, a construction change directive or any order for a minor change pursuant to this article 7, shall not be recognized as having any impact on the contract sum or the contract time and the contractor shall have no claim therefore. If the contractor believes that a directive or order would require it to perform work not required by the contract documents, the contractor shall so inform the owner in writing prior to complying with the same and in no event any later than five (5) working days from the day such direction or order was given, and shall submit to the owner for the owner's approval its change proposal.

§ 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:

.1 The change in the Work;
.2 The amount of the adjustment, if any, in the Contract Sum; and
.3 The extent of the adjustment, if any, in the Contract Time.

§ 7.2.2 Change Order shall include all costs, including cost of preparation of the change order, all impact and ripple costs associated with modifications or delays to the work an assessment of the amount and impact of any perceived potential delays, and all costs associated with modifications to other work.

.1 The Prime Contractor shall furnish all necessary documentation to support the additional cost, including but not limited to the following:

.1 Copy of subcontractor's proposal.
.2 Complete breakdown for all costs for labor and material.
.3 Complete breakdown of related costs.
.4 Other information as may be requested by the Owner.

§ 7.2.3 The overall cost of the Change Order shall be inclusive and once accepted by the Owner it shall be considered full and final.

§ 7.2.4 No additional time will be granted to the Contractor for minor change orders unless each individual change order totals more than $50,000.

§7.2.5 When a Change Order involves both additions and deletions in material, the net quantity is to be determined and the appropriate overhead and profit is to be applied to the net quantity.

§7.2.6 When any change in the Work, regardless of the reason therefore, requires or is alleged to require an adjustment in Contract Time, such request for time adjustment shall be submitted by the Contractor as part of the change proposal. Any Change Order approved by the Owner and for which payment is accepted by the Contractor, in which no adjustment in Contract Time is stipulated, shall be understood to mean that no such adjustment is required by reason of the change, and any and all rights of the Contractor or any subsequent request for adjustment of Contract Time by reason of the change is waived.

§7.2.7 Request by the Contractor for adjustment of the Contract Amount regardless of the reason therefore, shall be submitted to the Engineer and the Owner with itemized labor and material quantities and unit prices to permit proper evaluation of the request. A submission by the Contractor containing unsubstantiated lump sum requests for adjustment of the Contract Amount will not be considered by the Owner and Engineer. The Owner and Engineer will not be liable for any delay incurred by reason of the Contractor's failure to submit satisfactory justification and back-up with any request for adjustment to the Contract Amount.

§7.2.8 Agreement on any Change Order shall constitute a final settlement of all matters relating to the change in the initial Work which is the subject to the Change Order, including, but not limited to, all direct, indirect and impact costs associated with such change and any and all adjustment to the Contract Sum and the Construction Schedule. The Contractor will not be entitled to any compensation for additional work, impact costs or delays in the Construction Schedule not included in the Change Order.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

.1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;

.2 Unit prices stated in the Contract Documents or subsequently agreed upon;

.3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or

.4 As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

.1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;

.2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;

.3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;

.4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and

.5 Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

§ 7.5 OVERTIME AUTHORIZED BY OWNER

§7.5.1 When work beyond the normal working hours for the trade is authorized by the Owner, for his own reasons, in writing, the Contract Sum shall be adjusted by Change Order on the basis of premium payment for labor only plus the actual extra cost for insurance and taxes based on this premium payment. Overhead and profit will not be paid by the Owner for overtime so authorized.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The work to be performed under this Contract shall commence on October 22, 2018.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.2.4 Owner, or his representative, in coordination with the Contractor, shall set work hours. Contractor may be required to work nights, weekends or holidays as necessary to complete the work in accordance with the Schedule or in coordination with School Activities. Under no circumstances shall the Contractor begin or continue with work that is adversely impacting School activity or operations. All utility shutdowns, interruptions, work in or adjacent to existing buildings will be coordinated through the Owner, or his representative, and may have to be performed during hours when the School is not in operation. All cutting, hammering or other activity that is noisy, produces smoke or fumes or is otherwise disruptive to the School may have to be done during hours when the School is not in operation. Work required to be performed during non-school operating hours, as determined by the Owner or his representative, will be performed at no additional cost to the Owner.

§ 8.2.5 Contractor agrees to increase manpower, increase work hours, and to increase equipment necessary to maintain the Project Construction Schedule, and when also requested by the Engineer and the Owner, and shall be without additional cost or charge to the Owner.

§8.2.5 Work shall commence immediately and shall proceed uninterrupted to Final Completion. The Contractor acknowledges and recognizes that the Owner is entitled to full and beneficial occupancy and use of all or part of the completed Work in accordance with the Milestone Dates set forth in other sections of the Contract Documents, as per approved Schedule, and that the Owner has made arrangements to discharge its public obligations based upon the Contractor's achieving Substantial Completion of all of the Work within the Contract Time. The Contractor further acknowledges and agrees that if the Contractor fails to complete substantially or cause the Substantial Completion of any portion of the Work as required by the Project Construction Schedule and/or within the Contract Time, the Owner will sustain extensive damages and serious loss as a result of such failure. The exact amount of such damages will be extremely difficult to ascertain. Therefore, the Owner and the Contractor agrees as set forth below.

.1 If the Contractor fails to achieve partial completion within the requirements of the Milestone Dates or the approved Schedule or to achieve Substantial Completion of all or part of the Work when and as required by the Project Construction Schedule and/or within the Contract Time, the Owner shall be entitled to retain or recover from the Contractor and its Surety, as liquidated damages and not as a

penalty, the amounts indicated in other sections of the Contract Documents and commencing upon the first day following expiration of the Project Construction Schedule and/or the Contract Time, as the case may be, and continuing until the actual Date of Substantial Completion.

§8.2.6 Adherence to Schedule

.1 The Owner reserves the right to withhold monthly progress payments if the Contractor is behind schedule, unless the Contractor documents, in writing, any delays that are not the fault of the Contractor and to which the Owner and Engineer agree.

.2 Monthly progress payments will only be released after the Contractor reaches the status of completion for that month contemplated by the construction schedule.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.2.1 Any claim for extension of time should be made in writing to the Owner not more than five (5) days after the commencement of the delay, otherwise, it shall be waived. The Contractor shall provide an estimate of the probable effect of such delay on the progress of the work. No claim made beyond the five (5) days shall be considered valid.

§ 8.3.2.2 The Contractor agrees that if any delay in the Contractor's works unnecessarily delays the work of any other Contractor or Contractors, the Contractor shall in that case pay all costs and expenses incurred by such parties due to such delays and hereby authorizes the Owner to deduct the amount of such costs and expenses from any moneys due or to become due the Contractor under this Contract. The Owner shall be responsible for ascertaining whether the Contractor is responsible for delaying any of the work of any other Contractor. His decision shall be final.

§ 8.3.3 Notwithstanding anything to the contrary in the Contract Documents, any extension of the Contract Time, to the extent permitted under Paragraph 8.3.1., shall be the sole remedy of the Contractor for any (1) delay in the commencement, prosecution or completion of the Work, (2) hindrance or obstruction in the performance of the Work, (3) loss of productivity or (4) other similar claims (collectively referred to in this Paragraph 8.3.3. as "delays"), whether or not such delays are foreseeable, unless a delay is caused by acts of the Owner constituting active interference with the Contractor's performance of the Work and only to the extent such acts continue after the Contractor furnishes the Owner with written notice of such interference. In no event shall the Contractor be entitled to any compensation or recovery of any damages in connection with any delay including without limitation consequential damages, lost opportunity cost, impact damages or other similar remuneration. The Owner's exercise of any of its rights or remedies under the Contract Documents (including without limitation ordering changes in the Work or directing suspension, rescheduling or correction of the Work) regardless of the extent or frequency of the Owner's exercise of such rights or remedies shall not be construed as an act of interference with the Contractor's performance of the Work

§ 8.3.4 The Contractor agrees that the Owner can deduct from the Contract Sum, any wages paid by the Owner to any Inspector or Engineer or other professional necessarily employed by the Owner for any number of days in excess of the number of days allowed in the specifications for completion of work..

§ 8.3.5 Where the cause of delay is due to weather conditions, an extension of time shall be granted only for unusually severe weather, as determined by reference to historical data. The term "historical data" as used in the previous sentence shall be construed according to this formula: Average rainfall (or snow or low temperature) for the past five years.

§ 8.3.3 The Contractor shall be precluded from the recovery of damages for delay or for any impacts resulting from delay. This preclusion shall apply for any delays described in paragraph 8.3.1, including (but not limited to) delays caused by an act or neglect on the part of the Owner or Engineer or of an employee of either. The Contractor's sole remedy for any delay (or resulting impacts) shall be an appropriate extension of time for the completion of the Contract. In the event that a Contractor asserts in an arbitration, lawsuit or proceeding of any type, an entitlement to money damages or other damages other than an extension of time in violation of this provision, the Owner and the Engineer shall be entitled to reasonable attorney's fees and costs incurred in the defense of that matter. Anything contained in the General Conditions of the Contract for Construction, AIA Document A201-2007 or as amended, the Supplementary Conditions, the Specifications, the Contract, the Drawings or any other document to the contrary notwithstanding, the Contractor shall not be entitled to damages or to extra compensation by reason of delays occasioned by the proceedings to review the awarding of the Contract to the Contractor or to review the awarding of any other Contract to any other Contractor.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

§ 9.3 Applications for Payment

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the

Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within Fourteen days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- **.1** defective Work not remedied;
- **.2** third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
- **.3** failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;
- **.4** reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- **.5** damage to the Owner or a Separate Contractor;
- **.6** reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- **.7** repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

.1 If the Contractor disputes any determination by the Owner with regard to any Certificate of Payment, the Contractor nevertheless expeditiously shall continue to prosecute the Work.

.2 The failure of the Owner to retain any percentage payable to the Contractor or any change in or variation of the time, method or condition of payments to the Contractor shall not release or discharge to any extent whatsoever the Surety upon any bond given by Contractor hereunder. The Owner shall have the right, but not the duty, to disregard any schedule of items and costs that the Contractor may have furnished and defer or withhold in whole or in part any payment if it appears to the Owner, in its sole discretion, that the balance available in the Contract Sum as adjusted and less retained percentages, may be insufficient to complete the Work.

.3 Notwithstanding any provision of any law to the contrary, the Contractor agrees that the time and conditions for payment under the Contract for Construction shall be as stated in the Contract for Construction and in the Contract Documents. The Contractor specifically agrees that Owner's failure to give, or timely give, notice of:

.1 any error in an invoice or application for payment submitted by the Contractor for payment; or

.2 any deficiency or non-compliance with the Contract Documents with respect to any Work for which payment is requested, shall not waive or limit any of the Owner's rights or defenses under the Contract for Construction and the Contract Documents, or require the Owner to make a payment in advance of the time, or in an amount greater than, as provided by the Contract for Construction.

.4 The Contractor shall make payments to its subcontractors in accordance with the provisions of any applicable law governing the time, conditions, or requirements for payment to its Subcontractors, and shall comply with the provisions of any such law.

.1 The Contractor will pay its Subcontractors no later than (15) fifteen days after receipt of a payment from the Owner which includes payment for the work of any such Subcontractors.

.2 The Contractor shall require its Subcontractors, by appropriate agreement, to pay their subcontractors and suppliers (of any tier) within the same time.

.3 The Contractor and its Surety shall indemnify and defend the Owner any loss, cost, expenses, or damages including attorney's fees, arising from or relating to the Contractor's failure to comply with such law.

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented

to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- **.1** liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- **.2** failure of the Work to comply with the requirements of the Contract Documents;
- **.3** terms of special warranties required by the Contract Documents; or

.4 audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

9.11 LIQUIDATED DAMAGES

§ 9.11.1 The Contractor understands and agrees that all work must be performed in an orderly and closely coordinated sequence so that the date for substantial completion is met.

§ 9.11.2 If the Contractor fails to complete his work or fails to complete a portion of his work, he shall pay the Owner, as liquidated damages and not as a penalty, the sum as specified in the technical portion of the contract documents. Such amount is agreed upon as a reasonable and proper measure which the Owner will sustain each calendar day by failure of the Contractor to complete work within the stipulated time. Liquidated damages shall also apply to all Phased construction milestone dates as established by the phasing plan

§ 9.11.3 Substantial completion will be determined by the Owner.

§ 9.11.4 For damage occurring at the time of delay, the Owner may retain the amount due to him under this clause from any payments due to the Contractor.

§ 9.11.5 The Owner will suffer financial loss if the project is not substantially complete on the date set forth in the Contract Documents. The Contractor (and the Contractor's Surety) shall be liable for and pay to the Owner the sum of $500.00 stipulated and fixed, agreed as liquidated damages for each calendar day of delay until the work is substantially complete.

§ 9.11.6 FIVE HUNDRED ($500.00) PER DAY CALENDAR DAY FOR PUNCH LIST ITEMS.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.1.1 The Contractor must fully comply with the job safety requirements in addition to all Federal, State and Local safety guidelines. All cost associated with complying with all safety requirements shall be included in the Contract.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

.1 employees on the Work and other persons who may be affected thereby;

.2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and

.3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

§ 10.2.2.1Contractor shall comply with all regulations required by the Federal Occupational Safety and Health Act (OSHA).

§ 10.2.2.2 The Contractor shall conform to all applicable New Jersey Department of Environmental Protection regulations.

§ 10.2.2.3 Contractors must comply with Construction and Environmental Standards contained in Federal and State Regulations and other applicable laws.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities consistent with applicable laws, statutes, ordinances, codes, rules and regulations and lawful orders of public authorities, and prevailing industry practice.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 Injury or Damage to Person or Property
If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.2.9 The Contractor shall provide and maintain in good operating condition suitable and adequate fire protection equipment, and shall comply with all reasonable recommendations regarding fire protection made by the representatives of the fire insurance company carrying insurance on the Work or by the local fire chief or fire marshal. The area within the site limits under the Contractor's control shall be kept orderly and clean, and all combustible rubbish shall be promptly removed from the site. Contractor will comply with all reasonable requests of the Owner and Engineer with respect to additional security and protections required for work interfacing with School Operations. Safety is of utmost importance on this project and all issues relative to safety and protection of the School, Staff and Students will be treated as emergency needs and will not be subject to the 7-day notice requirements of Article 14.

§ 10.2.10 The Contractor shall remove snow or ice which may accumulate on the site within areas under his control which might result in damage or delay.

§ 10.2.11 The Contractor shall take all precautions necessary to prevent loss or damage caused by vandalism, theft, burglary, pilferage, or unexplained disappearance of property of the Owner and Contractor, whether or not forming part of the Work, located within those areas of the Project to which the Contractor has access. Whenever unattended, including nights and weekends, mobile equipment and operable machinery shall be kept locked and made inoperable and immovable.

§ 10.2.12 Neither the Owner and/or the Engineer shall be responsible for providing a safe working place for the Contractor, the Subcontractors or their employees, or any individual responsible to them for the work.

§ 10.2.13 The Contractor shall conform to requirements of OSHA, the Construction Safety Code of the State Department of Labor and those of the AGC Manual. The requirements of the New Jersey and Local Building Construction Codes shall apply where there are equal to or more restrictive than the requirements of the Federal Act.

§ 10.2.14 When all or a portion of the Work is suspended for any reason, the Contractor shall securely fasten down all coverings and protect the Work as necessary from injury or any cause.

§ 10.2.15 The Contractor shall promptly report in writing to the Owner and Engineer all accidents arising out of or in connection with the Work which caused death, personal injury or property damage giving full details and statements of any witnesses. In addition, if death, serious personal injury or serious property damage is caused, the accident shall be reported immediately by telephone or messenger to the Owner and Engineer.

§ 10.2.16 Contractor is required to follow and enforce the work rules set forth below. Failure to comply with or enforce any of these rules will be grounds for suspension and/or termination of this Contract:

.1 No use of alcoholic beverages prior to or during working hours. Anyone found impaired after lunch will be escorted from the Project site.

.2 No use of illegal drugs or prescription medications which could induce drowsiness or otherwise impair perception or performance. Use of illegal drugs may result in prosecution to the fullest extent of the law. Any warning associated with use of prescription drugs must be complied with, particularly warning against operation of machinery and equipment.

.3 No horseplay or rough-housing will be allowed.

.4 No sexual, racial, or ethnic harassment, or similar conduct will be tolerated.

.5 All employees shall use proper sanitation habits including use of toilet facilities and garbage cans.

.6 All employees shall dress in clothing appropriate for the work they are to perform. All personnel are to wear hardhats, safety shoes, glasses, gloves, masks or respirators, noise protection devices, and other protective clothing and equipment as required by OSHA standards.

.7 All equipment is to be property stored and/or secured at the end of the work day or if it is to remain idle for greater than one hour.

.8 All personnel are to be made aware of the availability of Material Safety Data Sheets for materials used at the Project site. This information is available from the Contractor using the product. The Contractor shall maintain a copy of all MSDS forms at the construction site office for all personnel to review.

§ 10.2.17 Contractor shall protect adjoining private or municipal property and shall provide barricades, temporary fences and covered walkways required by prudent construction practices, local building codes, ordinances or other laws, or the Contract Documents.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed

by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents.
§ 10.3.5 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss.

§11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense. If prior to the date of Substantial Completion the Contractor, a subcontractor or anyone for whom either is responsible, uses or damages any portion of the Work, including without limitation, mechanical, electrical, plumbing and other building systems, machinery, equipment or other mechanical device, the Contractor shall cause each such item to be restored to "like new condition" at no expense to the Owner.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Final Acceptance of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Final Acceptance by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the State of New Jersey and any dispute regarding the Contract shall be venued in Superior Court of New Jersey, Gloucester County.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until

after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.5 Interest

§ 13.5.1. The Contractor shall not be entitled to any payment of interest for any reason, action or inaction by the Engineer or the Owner.

§ 13.5.2 Any payments withheld for time delays, faulty materials, or workmanship, shall not bear interest for period of delay or non-acceptance.

§ 13.6 Anti Discrimination

§ 13.6.1 Pursuant to N.J.S.A. 10:2-1, Contractor agrees:

a. In the hiring of persons for the performance of work under this contract or any subcontract hereunder, or for the procurement, manufacture, assembling or furnishing of any such materials, equipment, supplies or services to be acquired under this contract, no contractor, nor any person acting on behalf of such contractor or subcontractor, shall, by reason of race, creed, color, national origin, ancestry, marital status, gender identity or expression, affectional or sexual orientation or sex, discriminate against any person who is qualified and available to perform the work to which the employment relates;
b. No contractor, subcontractor, nor any person on his behalf shall, in any manner, discriminate against or intimidate any employee engaged in the performance of work under this contract or any subcontract hereunder, or engaged in the procurement, manufacture, assembling or furnishing of any such materials, equipment, supplies or services to be acquired under such contract, on account of race, creed, color, national origin, ancestry, marital status, gender identity or expression, affectional or sexual orientation or sex;
c. There may be deducted from the amount payable to the contractor by the contracting public agency, under this contract, a penalty of $ 50.00 for each person for each calendar day during which such person is discriminated against or intimidated in violation of the provisions of the contract; and
d. This contract may be canceled or terminated by the contracting public agency, and all money due or to become due hereunder may be forfeited, for any violation of this section of the contract occurring after notice to the contractor from the contracting public agency of any prior violation of this section of the contract.

§ 13.7 Conflict of Interest

§ 13.7.1

a. No vendor shall pay, offer to pay, or agree to pay, either directly or indirectly, any fee, commission, compensation, gift, gratuity, or other thing of value of any kind to any State officer or employee or special State officer or employee, as defined by N.J.S.A. 52:13D-13b. and e., in the Department of the Treasury or any other agency with which such vendor transacts or offers or proposes to transact business, or to any member of the immediate family, as defined by N.J.S.A. 52:13D-13i., of any such officer or employee, or any partnership, firm, or corporation with which they are employed or associated, or in which such officer or employee has an interest within the meaning of N.J.S.A. 52:13D-13g.

b. The solicitation of any fee, commission, compensation, gift, gratuity or other thing of value by any State officer or employee or special State officer or employee from any State vendor shall be reported in writing forthwith by the vendor to the Attorney General and the Executive Commission on Ethical Standards.

c. No vendor may, directly or indirectly, undertake any private business, commercial or entrepreneurial relationship with, whether or not pursuant to employment, contract or other agreement, express or implied, or sell any interest in such vendor to, any State officer or employee or special State officer or employee having any duties or responsibilities in connection with the purchase, acquisition or sale of any property or services by or to any State agency or any instrumentality thereof, or with any person, firm or entity with which he is employed or associated or in which he has an interest within the meaning of N.J.S.A. 52:13D-13g. Any relationships subject to this provision shall be reported in writing forthwith to the Executive Commission on Ethical Standards, which may grant a waiver of this restriction upon application of the State officer or employee or special State officer or employee upon a finding that the present or proposed relationship does not present the potential, actuality or appearance of a conflict of interest.

d. No vendor shall influence, or attempt to influence or cause to be influenced, any State officer or employee or special State officer or employee in his official capacity in any manner which might tend to impair the objectivity or independence of judgment of said officer or employee.

e. No vendor shall cause or influence, or attempt to cause or influence, any State officer or employee or special State officer or employee to use, or attempt to use, his official position to secure unwarranted privileges or advantages for the vendor or any other person.

f. The provisions cited above in paragraph a. through e shall not be construed to prohibit a State officer or employee or special State officer or employee from receiving gifts from or contracting with vendors under the same terms and conditions as are offered or made available to members of the general public subject to any guidelines the Executive Commission on Ethical Standards may promulgate under paragraph 3c.

§ 13.8 Equal Pay

§ 13.8.1 Pursuant to N.J.S.A. 34:11-56.14(b), any employer, regardless of the location of the employer, who enters into a contract with a public body to perform any public work for the public body shall provide to the Commissioner of the New Jersey Department of Labor and Workforce Development, through certified payroll records required pursuant to N.J.S.A. 34:11-56.25 et seq., information regarding the gender, race, job title, occupational category, and rate of total compensation of every employee of the employer employed in the State in connection with the contract. The employer shall provide the Commissioner, throughout the duration of the contract or contracts, with an update to the information whenever payroll records are required to be submitted pursuant to N.J.S.A. 34:11-56.25 et seq.

§ 13.9 PREVAILING WAGE

§ 13.89.1 to the New Jersey Prevailing Wage Act, NJSA 34:11-56.27 et seq., is hereby made a part of this contract, which designates the workers employed in the performance of this contract shall be paid not less than such prevailing wage rateIn the event it is found that any worker, employed by the contractor or any subcontractor covered by said contract, has been paid a rate of wages less than the prevailing wage required to be paid by such contract, the University may terminate the contractor's or subcontractor's right to proceed with the work, or such part of the work as to which there has been a failure to pay required wages and to prosecute the work to completion or otherwise. The contractor and his sureties shall be liable for any excess costs occasioned thereby to the public body, any lessee to whom the public body is leasing a property or premises or any lessor from whom the public body is leasing or will be leasing a property or premises.

§ 13.10 Contractor shall maintain all documentation related to products, transactions or services under this contract for a period of five years from the date of final payment. Such records shall be made available to the New Jersey Office of the State Comptroller upon request

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

.1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;

.2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;

.3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment (without cause) within the time stated in the Contract Documents; or

§ 14.1.2 If one of the above reasons exist, the Contractor may, upon fourteen (14) days written notice to the Owner, terminate the Contract, unless this reason is cured prior to the expiration of the notice, and recover from the Owner payment of work properly executed in accordance with the Contract Documents (the basis for such payment shall be as provided in the Contract) and for payment for cost directly related to work thereafter performed by Contractor in terminating such work including reasonable demobilization and cancellation charges provided said work is authorized in advance by Architect and Owner.

§ 14.1.3 The Owner shall not be responsible for damages for loss of anticipated profits on work not performed on account of any termination described in Subparagraph 14.1.1 and 14.1.2.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

.1 refuses or fails to supply enough properly skilled workers or proper materials and/or equipment;

.2 fails to make prompt payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;

.3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or

.4 disregards the instructions of Owner (when such instructions are based on the requirements of the Contract Documents).

.5 Is adjudged bankrupt or insolvent, or makes a general assignment for the benefit of Contractor's creditors, or a trustee or a receiver is appointed for Contractor or for any of its property, or files a petition to take advantage of any debtor's act, or to recognize under bankruptcy or similar laws; or

.6 Breaches any warranty made by the Contractor under or pursuant to the Contact Documents.

.7 Fails to furnish the Owner with assurances satisfactory to the Owner evidencing the Contractor's ability to complete the Work in compliance with the requirements of the Contract Documents.

.8 Fails after the commencement of the Work to proceed continuously with the construction and completion of the work for more than 10 days except as permitted under the Contract Documents.

.9 Otherwise does not fully comply with the Contract Documents.

§ 14.2.2 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the costs of finishing the Work, including compensation for the services of any consultants and the Architect's services and expenses made necessary thereby, and the other costs and expenses identified hereinafter,

exceed the unpaid balance of the Contract Sum, the contractor and its Surety shall pay the difference to the Owner upon demand. The costs of finishing the Work include, without limitation, all reasonable attorney's fees, additional title costs, insurance, additional interest because of any delay in completing the Work, and all other direct and indirect consequential costs, including, without limitation, Liquidated Damages for untimely completion as specified in the Contract Documents, incurred by the Owner by reason of, or arising from, or relating to the termination of the Contractor as stated herein

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay or interruption as described in Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

.1 that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or

.2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

.1 cease operations as directed by the Owner in the notice;

.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and

.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Contractor shall be entitled to Owner payment for Work performed as of the date of termination in accordance with the contract Documents. The Contractor shall, as a condition of receiving the payments referred to herein, execute and deliver all such papers, turn over all plans, documents and files of whatsoever nature required by the Owner, and take all such steps, including the legal assignment of its contractual rights, as the Owner may require for the purpose of fully vesting in the Owner the rights and benefits of the Contractor. The Contractor warrants that it will enter into no subcontracts or other agreements that would adversely impact the Owner's rights or increase the Owner's obligations under this paragraph. In no event shall the Owner be liable to the Contractor for lost or anticipated profits or consequential damages, or for any amount in excess of the compensation due to the Contractor in accord with the Contract Documents for the Work performed as of the date of termination. The warranty and indemnity obligations of the Contractor and Surety shall survive and continue, notwithstanding any termination pursuant to this paragraph, with respect to the Work performed as of the date of termination.

§ 14.4.4 If Owner terminates the Contract for cause pursuant to Paragraph 14.2 and it is subsequently determined that the Owner was not authorized to terminate the Contract as provided in Paragraph 14.2, the Owner's termination shall be treated as a termination for convenience under this Paragraph 14.4 and the rights and obligations of the parties shall be the same as if the Owner has issued a notice of termination to the Contractor as provided in this Paragraph 14.4

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims
Issues involving the applicable statute of limitations shall be governed by New Jersey Law.

§ 13.7.1 No act or omission by the Owner or Engineer, or by anyone acting on behalf of either shall be deemed or construed as a waiver or limitation of any right or remedy under the Contract Documents, or as an admission, acceptance, or approval with respect to any breach of the Contract for Construction or failure to comply with the Contract Documents by the Contractor, unless the Owner expressly agrees, in writing.

§ 13.7.2 The Owner's exercise, or failure to exercise, any rights, claims or remedies it may have arising out of or relating to the Contract documents shall not release, prejudice, or discharge the Owner's other rights and remedies, nor shall it give rise to any right, claim, remedy or defense by any other person, including the Contractor, its Surety, any Subcontractor, or any other person or entity.

§ 13.7.3 Whenever possible, each provision of the Contract Documents shall be interpreted in a manner as to be effective and valid under applicable law, If, however, any provision of the Contract Documents, or portion thereof, is prohibited or found invalid by law, only such invalid provision or portion thereof shall be ineffective, and shall not invalidate or affect the remaining provision of the Contract Documents or valid portions of such provision, which shall be deemed severable. Further, if any provision of this Contract is deemed inconsistent with applicable law, applicable law shall control.

§ 13.8 Contractor shall promptly pay to Owner all costs and reasonable attorneys fees incurred in connection with any action or proceeding in which Owner prevails, based on a breach of the Contract or other dispute arising out of or in connection with the Contract.

§ 13.9 In the event of the appointment of a trustee and/or receiver or any similar occurrence affecting the management of the account of the Contractor pertaining to the Work, it shall be the obligation of the Contractor, its representatives, receivers, sureties, or successors in interest to continue the progress of the Work without delay and specifically to make timely payment to Subcontractors and Suppliers of all amounts that are lawfully due them and to provide the Owner and all Subcontractors and Suppliers whose work may be affected with timely notice of the status of receivership, bankruptcy, etc., and the status of their individual accounts.

§ 13.10 Regularly scheduled job meetings shall be held at a location and time convenient to the Owner's representatives, the Engineer and the Contractor. The Contractor shall attend such meetings, or be represented by a person in authority who can speak for and make decisions for the Contractor.

§ 15.1.3 Notice of Claims
§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance
§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction.

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§15.2.5.1 All claims and disputes and other matters in question between the Contractor and the Owner arising out of or relating to the Contract Documents or a breach thereof with regard to the Engineer's decision, shall be decided through suit in New Jersey Superior Court, Camden County, and Contractor consents to the jurisdiction of the New Jersey Superior Court. The Contractor shall carry on all work and maintain its progress during such suit and the

Owner shall continue to make payments not related to the dispute of the Contractor in accordance with Contract Documents.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

DRAFT

AIA® Document A101™ – 2017

Standard Form of Agreement Between Owner and Contractor

where the basis of payment is a Stipulated Sum

AGREEMENT made as of the __day of _____in the year 2020
(In words, indicate day, month and year.)

BETWEEN the Owner:
Rowan University
201 Mullica Hill Road
Glassboro, NJ 08028

and the Contractor:

for the following Project:

The Architect:

The Owner and Contractor agree as follows.

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

The parties should complete A101™–2017, Exhibit A, Insurance and Bonds, contemporaneously with this Agreement. AIA Document A201™–2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

ELECTRONIC COPYING of any portion of this AIA® Document to another electronic file is prohibited and constitutes a violation of copyright laws as set forth in the footer of this document.

TABLE OF ARTICLES

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement, Bid Solicitation, Bid Submission and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be

[« »] The date of this Agreement.

[X] A date set forth in a notice to proceed issued by the Owner.

[« »] Established as follows:
(Insert a date or a means to determine the date of commencement of the Work.)

« »

If a date of commencement of the Work is not selected, then the date of commencement shall be the date of this Agreement.

§ 3.2 The Contract Time shall be measured from the date of commencement of the Work. **TIME IS OF THE ESSENCE.**

§ 3.3 Substantial Completion

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work:
(Check one of the following boxes and complete the necessary information.)

[ ] Not later than () calendar days from the date of commencement of the Work.

[X] By the following date:

§ 3.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work are to be completed prior to Substantial Completion of the entire Work, the Contractor shall achieve Substantial Completion of such portions by the following dates:

Portion of Work	Substantial Completion Date
Entire Scope of Work	

§ 3.3.3 If the Contractor fails to achieve Substantial Completion as provided in this Section 3.3, liquidated damages, if any, shall be assessed as set forth below:

Liquidated damages of $5000 per day for each calendar day substantial completion is not achieved.

Liquidated damages of $5000 per day for each calendar day work on the closeout/punch list is incomplete

§ 3.4 By submission of the its Bid and execution of the Contract, the Contractor agrees that the time specified for Final Completion of the Work is a reasonable period for completion of the Work taking into consideration the average climatic range, material delivery time experience in the Contractor's industry.

§ 3.5 Should the Contractor fail to substantially complete the Work by the date set for Substantial Completion set forth above, the Contractor shall and hereby agrees to pay the Owner the sum of **$1000 per day** for each consecutive calendar day which elapses between the above-referenced date set for Substantial Completion and the date of actual Substantial Completion as certified to and approved by the Owner. Should the Contractor fail to fully complete the Work in conformity with all provisions of the Contract by the date set for Final Completion set forth above, the Contractor shall and hereby agrees to pay the Owner the sum of **$1000 per day** for each consecutive calendar day which elapses between the above-referenced date set for Final Completion and the date of actual Final Completion as certified to and approved by the Owner.

§ 3.6 The per day liquidated damages sum referenced herein is hereby agreed to be a reasonable and proper measure of damages which the Owner will sustain per diem by failure of Contractor to complete Work within time as stipulated; it being recognized by Owner and Contractor that the damages suffered by Owner which could result from a failure of the Contractor to complete the Work on schedule is uncertain and cannot be calculated with any degree of mathematical certainty. In no way shall costs of Liquidated Damages be construed as a penalty to the Contractor. In addition to liquidated damages, Owner shall have the right to recover the actual damages as are capable of being ascertained and which are not duplicative of elements covered by the liquidated damages provisions. Nothing in this paragraph shall limit the right of Owner to complete the Work following the Contractor's breach of contract.

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be ($), subject to additions and deductions as provided in the Contract Documents.

§ 4.2 Alternates

§ 4.2.1 Alternates, if any, are inclusive of the total Contract Sum:

Item	Price

§ 4.2.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement.

(Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)

Item	Price	Conditions for Acceptance

§ 4.3 Allowances, if any, included in the total Contract Sum reflected in Section 4.1:
(Identify each allowance.)

Item	Price

§ 4.4 Unit prices, if any:
(Identify the item and state the unit price and quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price per Unit ($0.00)

§ 4.5 Liquidated damages, if any:
(Insert terms and conditions for liquidated damages, if any.)

See Sections 3.3, 3.4, 3.5, and 3.6 above.

§ 4.6 Other:
(Insert provisions for bonus or other incentives, if any, that might result in a change to the Contract Sum.)

Not Applicable.

ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month.

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the last day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the last day of the following month. If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner not later than Forty Five (45) days after the Architect receives the Application for Payment.
(Federal, state or local laws may require payment within a certain period of time.)

§ 5.1.3.1 APPLICATIONS FOR PAYMENT: The form for Applications for Payment shall be a notarized AIA Document G702, Application and Certification for Payment, supported by AIA document G703 Continuation Sheets. Each Application for Payment must be accompanied by three (3) sets of Certified Payroll Records for the period covered by the Application. The payroll records shall indicate the proper classification of employees and the payment of overtime, if any. These records shall include each Contractor's subcontractor's certified payroll. Payment will not be authorized if the required payroll records have not been submitted.

§ 5.1.3.2 All Applications for Payment, Certified Payroll Records and Manning Reports shall include the relevant purchase order number and project number.

§ 5.1.4 The Owner may decide to disapprove an Application for Payment, or withhold payment, in whole or in part, to the extent reasonably necessary to protect the Owner if, in its opinion, the representations as described in Section 5.1.4.1 below cannot be made. If the Owner withholds a Certificate for Payment, the Owner will notify the

Contractor as provided in Article 5 hereof. The Owner may also decide to withhold certifying payment in whole or in part, because of subsequently discovered evidence or subsequent observations, to such extent as may be necessary to protect the Owner from loss because of:

1. Defective Work which has not been remedied;
2. Third party claims filed or reasonable belief probable filing of such claims;
3. Failure of the Contractor to make payments properly to vendors, subcontractors or for labor, materials and equipment;
4. Reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract sum;
5. Damage to the Owner or another contractor;
6. Reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay;
7. Failure to carry out the Work in accordance with the Contract Documents;
8. Avoidable delay in the progress of the Work;
10. Failure to maintain the Project Site in a safe and satisfactory condition in accordance with good construction practices as recommended by the Engineer after consultation with the Contractor; and
11. Failure to submit updates as requested by the Owner or as required by the General Conditions.

When the foregoing reasons for withholding payment are resolved, certification will be made for amounts previously withheld in the manner set forth in Section 5.1.3 above.

§ 5.1.4.1 The issuance of a separate Certificate for Payment will constitute representations by the Owner's Project Manager to the Owner, based on its individual observations at the Site and the data comprising the Application for Payment submitted by the Contractor, that the Work has progressed to the point indicated and that, to the best of the Owner's knowledge, information and belief, quality of the Work is in accordance with the Contract Documents. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to minor deviations from the Contract Documents correctable prior to completion and to specific qualifications expressed by the Engineer. The issuance of a separate Certificate for Payment will further constitute a representation that the Contactor is entitled to payment in the amount certified. However, the issuance of a separate Certificate for Payment will not be a representation that the Owner has: (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed the Contractor's construction means, methods, techniques, sequences or procedures; (3) reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contact Sum.

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form, and supported by such data to substantiate its accuracy, as the Architect may require. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.6 In accordance with AIA Document A201™–2017, General Conditions of the Contract for Construction, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.1.6.1 The amount of each progress payment shall first include:

.1 That portion of the Contract Sum properly allocable to completed Work;

.2 That portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing; and

.3 That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified.

§ 5.1.6.2 The amount of each progress payment shall then be reduced by:

.1 The aggregate of any amounts previously paid by the Owner;

.2 The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201–2017;

.3 Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;

.4 For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201–2017; and

.5 Retainage withheld pursuant to Section 5.1.7.

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due:

(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)

Retainage shall be determined as follows:, the Owner will withhold Five percent (5%) of the amount due on each partial payment when the outstanding balance of the Contract is more than $500,000. When the outstanding balance of the Contract is Five Hundred Thousand Dollars ($500,000.00) or less, Owner will withhold five percent (10%) as retainage. Retainage shall be withheld until the Owner determines that the work has been satisfactorily completed and no unsettled claims exist. The final acceptance shall not be binding or conclusive upon the Owner should it subsequently discover that the contractor has supplied inferior material or workmanship or has departed from the terms of his contract. Should such a condition appear the Owner shall have the right, notwithstanding final acceptance and payment, to cause the work to be properly done in accordance with the drawings and specifications at the cost and expense of the contractor.

§ 5.1.7.1.1 The following items are not subject to retainage:

(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)

None.

§ 5.1.7.2 Reduction or limitation of retainage, if any, shall be as follows:

(If the retainage established in Section 5.1.7.1 is to be modified prior to Substantial Completion of the entire Work, including modifications for Substantial Completion of portions of the Work as provided in Section 3.3.2, insert provisions for such modifications.)

None.

§ 5.1.7.3

Intentionally Omitted.

§ 5.1.8 If final completion of the Work is materially delayed through no fault of the Contractor, the Owner shall pay the Contractor any additional amounts in accordance with Article 9 of AIA Document A201–2017.

§ 5.1.9 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.2 Final Payment

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

.1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Article 12 of AIA Document A201–2017, and to satisfy other requirements, if any, which extend beyond final payment; and

.2 a final Certificate for Payment has been issued by the Architect.

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 45 days after the issuance of the final Certificate for Payment.

« »

§ 5.3 Interest
Payments due and unpaid under the Contract shall bear no interest from the date payment is due at the rate stated below.

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Initial Decision Maker
The Architect will serve as the Initial Decision Maker pursuant to Article 15 of AIA Document A201–2017, unless the parties appoint below another individual, not a party to this Agreement, to serve as the Initial Decision Maker.

« »

§ 6.2 Binding Dispute Resolution
For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A201–2017, the method of binding dispute resolution shall be as follows:
(Check the appropriate box.)

[« »] Arbitration pursuant to Section 15.4 of AIA Document A201–2017

[X] Litigation in New Jersey Superior Court, Gloucester County.

[« »] Other *(Specify)*

« »

If the Owner and Contractor do not select a method of binding dispute resolution, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.

ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2017.

« »

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2017.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2017 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 The Owner's representative:
(Name, address, email address, and other information)

_____ Project Manager
Rowan University
201 Mullica Hill Road
Glassboro, NJ 02028

@rowan.edu

§ 8.3 The Contractor's representative:
(Name, address, email address, and other information)

§ 8.4 Neither the Owner's nor the Contractor's representative shall be changed without ten days' prior notice to the other party.

§ 8.5 Insurance and Bonds

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, Exhibit A, Insurance and Bonds, and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in AIA Document A101™–2017 Exhibit A, and elsewhere in the Contract Documents.

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A201–2017, may be given in accordance with AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:

(If other than in accordance with AIA Document E203–2013, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)

« »

§ 8.7 Other provisions:

§8.8 It is the obligation of the Contractor to provide a full and complete copy of all insurance policies held by it at the Contractor's sole expense, upon reasonable request by the Owner, in the amounts specified in the Bid Documents (see Article 11 of modified AIA Document A201-2007 General Conditions of the Contract for Construction). The Contractor's failure to obtain or maintain adequate insurance coverage shall result in the immediate termination of this Agreement. The Owner will have the right to request copies of the Contractor's insurance policies or any part thereof for the duration of the contract period.

§8.9 This Agreement, the General Conditions of the Contract as modified or supplemented in writing, and the Supplemental General Conditions
shall control in the case of conflict between these documents and the Project Specifications, the Project Manual and any other exhibits incorporated by reference into this Agreement in Article 9 herein.

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor
.2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds
.3 AIA Document A201™–2017, General Conditions of the Contract for Construction
.4 Drawings: None
.5 Project Manual

Section	Title	Date	Pages

DIVISION 01 GENERAL REQUIREMENTS DATED October 4, 2018

Section	Title	Date	Pages

TECHNICAL SPECIFICATIONS

Section	Title	Date

.7 Addenda, if any:

Number	Date	Pages

Portions of Addenda relating to bidding or proposal requirements are not part of the Contract Documents unless the bidding or proposal requirements are also enumerated in this Article 9.

.8 Other Exhibits:
(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

[« »] AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:
(Insert the date of the E204-2017 incorporated into this Agreement.)

« »

[« »] The Sustainability Plan:

Title	Date	Pages

[« »] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

.9 Other documents, if any, listed below:
(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201™–2017 provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.)

The Bid Package attached hereto as Exhibit "A"
Contractor's Bid attached hereto as Exhibit "B"
Affirmative Action Attachment (Exhibit B) attached hereto as Exhibit "C"
Project Labor Agreement attached hereto as Exhibit "D"

This Agreement entered into as of the day and year first written above.

OWNER *(Signature)*	**CONTRACTOR** *(Signature)*
Joseph Scully, CFO	

Rowan University

PLANNING AND CONSTRUCTION

ALLOWANCE AUTHORIZATION

Project: _____

_____

Vendor: _____

_____

Allowance Authorization Number: _____

Date: _____

RU Project Number: _____

PO Number: _____

You are authorized to perform the following item(s) of work and to adjust the Allowance Sum accordingly:

This authorization is due to:
☐ Owners Request ☐ Field Condition Requirement ☐ Unforeseen Condition ☐ Design Error/Omission ☐ DCA Request

Explain:

THIS IS NOT A CHANGE ORDER AND DOES NOT INCREASE OR DECREASE THE CONTRACT AMOUNT

Original Allowance ..... $
Allowance Expenditures prior to this Authorization..... $
Allowance Balance prior to this Authorization..... $
Allowance will be [increased] [decreased] by this Authorization..... $
New Allowance Balance..... $

APPROVAL RECOMMENDED

_____
Rowan Project Manager Date

_____
VP Administration and Finance Date
(amounts >$30,099.99)

_____
AVP Facilities Date
(amounts > $6,019.99)

☐ Attachments

Copies: ☐ Owner ☐ Contractor ☐ Consultants ☐ _____ ☐ _____ ☐ _____ ☐ File

Revision 1 – October 2010

Rowan University

PLANNING AND CONSTRUCTION

ALLOWANCE CHARGE REQUEST (PROPOSAL)

Project: _____

_____

To: _____

_____

Re: _____

Allowance Charge Request Number: _____

From (Contractor): _____

Date: _____

RU Project Number: _____

PO Number: _____

This Allowance Charge Request contains charges to be made against the contract allowance

Description of Proposed Charge:

Attached supporting information from: Subcontractor Supplier

Reason for Charge:

Attached pages: Proposal Worksheet Summary:
Proposal Worksheet Details:

Signed by: Date:

Copies: ☐ Owner ☐ Contractor ☐ Consultants ☐ _____ ☐ _____ ☐ _____ ☐ File

Revision 0 – September 2010

Rowan University

Facilities Planning & Construction

REQUEST FOR INFORMATION

RFI No:

Rowan Project No./Description:	Date Submitted:
	Requested Response Date:
	Actual Response Date:
Rowan Project Manager:	
Submitted to:	
Company:	

Contract Document Reference:

RFI DISCUSSION

Individually number each separate topic or question

Submitted by (Name & Company): Title: Date:

RFI RESPONSE

Answered by (Name & Company): Title: Date:

CHANGE ORDER REQUEST

OWNER ☐
ARCHITECT ☐
CONTRACTOR ☐
FIELD ☐
OTHER ☐

PROJECT: (name, address)

CHANGE ORDER REQUEST NUMBER:

DATE OF ISSUANCE:

ARCHITECT'S PROJECT NO:

CONTRACT FOR:

OWNER: (name, address)

CONTRACT DATE:

ARCHITECT: (name, address)

FROM CONTRACTOR: (name, address)

The contractor must submit this proposal with all appropriate documentation and/or notify the Architect or Owner, in writing, of the date on which proposal submission is anticipated.

THIS IS NOT A CHANGE ORDER, A CONSTRUCTION DIRECTIVE OR A DIRECTION TO PROCEED WITH THE WORK DESCRIBED IN THE PROPOSED MODIFICTIONS.

DESCRIPTION: (Insert a written description of the Work)

ATTACHMENTS: (List attached documents that support description)

REQUESTED BY THE CONTRACTOR:

(Signature)

(Printed Name and title)

CHANGE ORDER

OWNER ☐
ARCHITECT ☐
CONTRACTOR ☐
FIELD ☐
OTHER ☐

PROJECT:
(name, address)

CHANGE ORDER NUMBER:

DATE:

TO CONTRACTOR:
(name, address)

ARCHITECT'S PROJECT NO:

CONTRACT DATE:

CONTRACT FOR:

PURCHASE ORDER NO:

The Contract is changed as follows:

Not valid until signed by the Owner, Architect and Contractor.

The original (Contract Sum) (Guaranteed Maximum Price) was
New change by previously authorized Change Orders
The (Contract Sum) (Guaranteed Maximum Price) prior to this Change Order was
The (Contract Sum) (Guaranteed Maximum Price) will be (increased) (decreased) (unchanged) by this Change Order in the amount of
The new (Contract Sum) (Guaranteed Maximum Price) including this Change Order will be

The Contract Time will be (increased) (decreased) (unchanged) by ( ) days.
The date of Substantial Completion as of the date of this Change Order therefore is

NOTE: This summary does not reflect changes in the Contract Sum, Contract Time or Guaranteed Maximum Price which have been authorized by Construction Change Directive.

_____	_____	Rowan University
ARCHITECT	CONTRACTOR	OWNER
_____	_____	201 Mullica Hill Road
Address	Address	Address
_____	_____	Glassboro, NJ 08028-1701
BY_____	BY_____	BY_____
DATE_____	DATE_____	DATE_____

RowanUniversity

PROJECT NAME		**PROJECT NO.**	
CONTRACTOR		**CONTRACT NO.**	
SUBCONTRACTOR		**DATE**	

HOURLY LABOR RATE BREAKDOWN FORM

All Contractors (Including sub-subcontractors) need to include a detailed breakdown of all wage rates, payroll burden costs and material costs for lump sum and time and material extras. Payroll burden items, FICA, FUI, SUI, and Workmen's Compensation will be reimbursed on an average annualized basis. **This information must be provided for all trade to be utilized on the project by any and all contractors at the time of contractors bid submission.** The required format is as follows:
(Reference 'Change Orders' in AIA 201 General Conditions. Certified payrolls required for all workers on Project.)

TRADE: **CLASSIFICATION:**

Item	Benefit Paid	Benefit Provided	Rate Per $100	Prevailing Wage Rate: Regular Time	Overtime	Double Time	Notes
Base Labor Rate							*Use certified payroll to verify.*
	Benefit Paid	Benefit Provided					
Fringe Benefits:	(put X in appropriate box)						
Pension [1]							
Annuity Fund [1]							
Health/Welfare [1]							
Training/Certification [1]							
Vacation [1]							
Paid Holiday [1]							
Associate Dues [1]							
Other [1]							
Fringe Benefits Subtotal							
Total PW Hourly Rate							*= Base Labor Rate + Benefits*
Benefits Paid							
Total Paid Hourly Rate							*= Base Labor Rate + Benefits*
Burden: Taxes & Insurance [2]							
FICA							
Medicare							
Federal Unemployment							
State Unemployment							*Maximum - 0.062.*
Workers Compensation [1]							*Usually less than 11%; can*
Other [1]							
Other [1]							
Burden Subtotal							
Contractor Liability Insurance				N/A	N/A	N/A	*Included in OH&P*
Small Tools				N/A	N/A	N/A	*Included in OH&P*
Other (warranty, record drawings, payment bonds, performance bonds, etc.)				N/A	N/A	N/A	*Included in OH&P*
TOTAL HOURLY RATE (Total Hourly Rate + Burden)							*= Amount Contractor paid to employee*

Note: For change order work, mark-ups for overhead and profit shall be applied to the above rates (these rates are subject to audit) in accordance with the provisions of AIA 201 General Conditions, under 'Change Orders'.

[1] Costs for Overtime and Double Time are same as for Regular Time.

[2] Taxes & Insurance apply to Total Paid Hourly Rate which includes Base Labor Rate plus benefits paid in cash.

By signing below, the submitter certifies and declares under penalty of perjury under the laws of the State of New Jersey that the foregoing is true and correct.

Rates certified by: _____ (print name)

Company Name: _____

Signature: _____

Date: _____

RowanUniversity

PROJECT NAME	**Superiority Hall Renovation Project**	**PROJECT NO.**	**RU00000**
CONTRACTOR	**Cut No Corners Contractors**	**CONTRACT NO.**	**PO000000**
SUBCONTRACTOR	**Don Write Electrical**	**DATE**	**1/1/2019**

HOURLY LABOR RATE BREAKDOWN FORM

All Contractors (Including sub-subcontractors) need to include a detailed breakdown of all wage rates, payroll burden costs and material costs for lump sum and time and material extras. Payroll burden items, FICA, FUI, SUI, and Workmen's Compensation will be reimbursed on an average annualized basis. **This information must be provided for all trade to be utilized on the project by any and all contractors at the time of contractors bid submission.** The required format is as follows:
(Reference 'Change Orders' in AIA 201 General Conditions. Certified payrolls required for all workers on Project.)

TRADE: Electrical **CLASSIFICATION:** Electrical Forman

Item	Benefit Paid	Benefit Provided	Rate Per $100	Prevailing Wage Rate: Regular Time	Overtime	Double Time	Notes
Base Labor Rate				$ 37.40	$ 56.10	$ 74.80	*Use certified payroll to verify.*
	Benefit Paid	Benefit Provided					
Fringe Benefits:	(put X in appropriate box)						
Pension [1]		X		5.65	5.65	5.65	
Annuity Fund [1]		X		-	-	-	
Health/Welfare [1]	X			10.40	10.40	10.40	
Training/Certification [1]	X			0.70	0.70	0.70	
Vacation [1]		X		-	-	-	
Paid Holiday [1]		X		-	-	-	
Associate Dues [1]		X		-	-	-	
Other [1]		X		0.41	0.41	0.41	
Fringe Benefits Subtotal				$ 17.16	$ 17.16	$ 17.16	
Total PW Hourly Rate				$ 54.56	$ 73.26	$ 91.96	*= Base Labor Rate + Benefits*
Benefits Paid				$ 11.10	$ 11.10	$ 11.10	
Total Paid Hourly Rate				$ 48.50	$ 67.20	$ 85.90	*= Base Labor Rate + Benefits*
Burden: Taxes & Insurance [2]							
FICA			0.0620	3.01	4.17	5.33	
Medicare			0.0145	0.70	0.97	1.25	
Federal Unemployment			0.0080	0.39	0.54	0.69	
State Unemployment				-	-	-	*Maximum - 0.062.*
Workers Compensation [1]				-	-	-	*Usually less than 11%; can*
Other [1]				-	-	-	
Other [1]				-	-	-	
Burden Subtotal				$ 4.10	$ 5.68	$ 7.26	
Contractor Liability Insurance				N/A	N/A	N/A	*Included in OH&P*
Small Tools				N/A	N/A	N/A	*Included in OH&P*
Other (warranty, record drawings, payment bonds, performance bonds, etc.)				N/A	N/A	N/A	*Included in OH&P*
TOTAL HOURLY RATE (Total Hourly Rate + Burden)				**$ 58.66**	**$ 78.94**	**$ 99.22**	*= Amount Contractor paid to employee*

Note: For change order work, mark-ups for overhead and profit shall be applied to the above rates (these rates are subject to audit) in accordance with the provisions of AIA 201 General Conditions, under 'Change Orders'.

[1] Costs for Overtime and Double Time are same as for Regular Time.

[2] Taxes & Insurance apply to Total Paid Hourly Rate which includes Base Labor Rate plus benefits paid in cash.

By signing below, the submitter certifies and declares under penalty of perjury under the laws of the State of New Jersey that the foregoing is true and correct.

Rates certified by: **Don Write** (print name) Company Name: **Don Write Electrical**

Signature: *Don Write* Date: *1/1/2019*

DAILY JOB REPORT

Project #

DATE:				
WEATHER CONDITIONS:				
VISITORS:				
CONTRACTORS ON SITE:	***SUPER ON SITE (Y/N):***	**WORKFORCE ON SITE: (Foreman, Tradesmen, Laborers, etc.)**	***NO. OF WORKERS***	***WORK BEING DONE:***
MATERIALS DELIVERED:			***EQUIPMENT ONSITE:***	
PROBLEMS/STATUS/CAUSES FOR DELAY:				
NOTEWORTHY PHONE CALLS:				

APPLICATION AND CERTIFICATE FOR PAYMENT

AIA DOCUMENT G702

TO OWNER:

PROJECT:

APPLICATION NO:

PERIOD TO:

PROJECT/CONTRACT NO:

FROM CONTRACTOR:

VIA ENGINEER:

CONTRACT DATE:

APPLICATION DATE:

CONTRACTOR'S APPLICATION FOR PAYMENT

CHANGE ORDER SUMMARY			
Change Orders approved in previous months by owner		ADDITIONS	DEDUCTIONS
TOTAL			
Approved This Month			
Number	Date Approved		
TOTALS			
Net Change By Change Orders			

The undersigned Contractor certifies that to the best of the Contractor's knowledge, information and belief the work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for Work for which previous Certificates for Payment were issued and payments received from the Owner, and that current payment shown herein is now due.

CONTRACTOR:

By: _____ Date: _____

Application is made for Payment, as shown below, in connection with the Contract.
Continuation Sheet, AIA Document G703, is attached.

1. ORIGINAL CONTRACT SUM..... _____
2. Net change by Change Orders..... _____
3. CONTRACT SUM TO DATE (LINE 1 + 2)..... _____
4. TOTAL COMPLETED & STORED TO DATE..... _____
   {Column G on G703}
5. Retainage:
   a. _____ % of Completed Work.. _____
      {Column D + E on G703}
   b. 0 % of Stored Materials... _____
      {Column f on G703}
   Total Retainage (line 5a + 5b or
   Total in Column I of G703)..... _____
6. TOTAL EARNED LESS RETAINAGE..... _____
   {Line 4 less Line 5 Total}
7. LESS PREVIOUS CERTIFICATES FOR
   PAYMENT (Line 6 from prior Certificate)..... _____
8. **CURRENT PAYMENT DUE**..... _____
9. BALANCE TO FINISH, PLUS RETAINAGE..... _____
   {Line 3 less Line 6}

State County of:
Subscribed and sworn to before me this day of 2010
Notary Public:
My Commission expires:

ARCHITECT'S CERTIFICATE FOR PAYMENT

In accordance with the Contract Documents, Based on on-site observations and the data comprising the above application, the Architect certifies to the Owner that to the best of the Architect's knowledge, information and belief the Work has progressed as indicated, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment of the AMOUNT CERTIFIED.

AMOUNT CERTIFIED..... $ _____

{Attach explanation if amount certified differs from the amount applied for.}

ARCHITECT:

By: _____ Date: _____

This Certificate is not negotiable. THE AMOUNT CERTIFIED is payable only to the Contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract.

CONTINUATION SHEET

AIA Document G702, APPLICATION AND CERTIFICATE FOR PAYMENT, containing
Contractor's signed Certification is attached.
In tabulations below, amounts are stated to the nearest dollar
Use Column I on Contracts where variable retainage for line items may apply.

APPLICATION NO:
APPLICATION DATE:
PERIOD TO:
PROJECT NO:

A	B			C	C	D			E			F	G	H	I
									WORK COMPLETED						
ITEM NO.	DESCRIPTION OF WORK	QUANTITY	UNIT OF MEASURE	PRICE	SCHEDULED VALUE	FROM PREVIOUS APPLICATION	UNIT OF MEASURE	TOTAL	COMPLETED THIS PERIOD	UNIT OF MEASURE	TOTAL	MATERIALS PRESENTLY STORED NOT IN D OR E	TOTAL COMPLETED AND STORED TO DATE D+E+F	% G/C	BALANCE TO FINISH C - G

Attachment to G702 (or equivalent)
Certification for Payment

Project Name:_____
Project Number:_____Payment Number:____

I, _____, a prime contractor working for Rowan University on the above-mentioned project, hereby certify as required by P.L. 191, c.507 of the State of New Jersey that: **(you must check one under "A" and one under "B")**

A. With respect to previous progress payments:

( ) all my sub-contractors and suppliers have been paid all amounts due from all previous progress payments I have received from Rowan University for my work on this project

( ) all my sub-contractors and suppliers have been paid all amounts due from all previous progress payments with the exception of those listed below for which payment is being withheld as there exists a valid basis for those sub-contractors and suppliers listed below under the terms of their contract(s) to withhold payment from each such sub-contractor and supplier:

1._____

2._____

3._____

For each such sub-contractor and supplier for which payment is being withheld, I further certify that written notice detailing the specific reason(s) for withholding payment has been provided to each such sub-contractor and supplier with copies

thereof provided to my performance bond company and Rowan University.

B. With respect to this payment number_____:

( ) all my sub-contractors and suppliers shall be paid all amounts due from this progress payment

( ) all my sub-contractors and suppliers shall be paid all amounts due from this progress payment with the exception of those listed below for which payment will be withheld as there exists a valid basis for those sub-contractors and suppliers listed below under the terms of their contract(s) to withhold payment from each such sub-contractor and supplier:

1._____

2._____

3._____

For each sub-contractor and supplier for which payment is being withheld, I further certify that written notice detailing the specific reason(s) for withholding payment has been provided to each sub-contractor and supplier with copies thereof provided to my performance bond company and Rowan University.

I certify that the above statements are true. I am aware that if any of the above statements are willfully false, I am subject to punishment.

Dated:_____ _____

Signature

_____

Please Print Name

CONTRACTOR'S PARTIAL OR FINAL RELEASE AND WAIVER OF LIENS

OWNER: **CONTRACT FOR:**

OWNER'S AGENT:

PROJECT: **CONTRACT DATE:**

Upon receipt by the undersigned Contractor of a check from Owner in the sum of $_____, which check will consume payment of all sums due the Contractor for labor, equipment and/or materials supplied in connection with the Project, and when said check has been paid by the bank upon which it is drawn, this document shall become effective to fully and finally waive and release any and all liens, claims, liabilities, actions, and demands that this Contractor and all its subcontractors have or might have against Owner, Lender, the Project, the real property upon which the Project is located and any and all other property owned by Owner on account of or in connection with labor, equipment and/or materials supplied by the undersigned to the Project.

The undersigned Contractor does hereby further acknowledge and represent that through the date hereof the undersigned has received payments totaling $_____ for labor, equipment and/or materials supplied to the Project.

This instrument has been executed as of the _____ day of _____, 20__.

CONTRACTOR:

_____

By: _____

Name: _____

Title: _____

STATE OF _____ δ
δ
COUNTY OF _____ δ

Sworn to and subscribed before me the undersigned authority on this _____ day of _____, 20__.

[S E A L]

_____
Notary Public, State of _____

My Commission Expires:

_____

_____
Printed Name of Notary Public

Rowan University

To Whom It May Concern:

Your recent request to Rowan University requesting information or a tax exempt form is hereby acknowledged.

It has been determined that Rowan University is a government body and is Exempt from New Jersey Sales and Use Taxes imposed by the Sales and Use Tax Act (P.L. 1966, c.30 and c.52). An opinion from the State of New Jersey, Office of the Attorney General has been reproduced below.

If you have any questions, please contact the Accounts Payable Office at (856) 256-4115.

Sincerely,

Joseph F. Scully, Jr.
Vice President for Finance & CFO

State of New Jersey

CHRIS CHRISTIE
Governor

KIM GUADAGNO
Lt. Governor

OFFICE OF THE ATTORNEY GENERAL
DEPARTMENT OF LAW AND PUBLIC SAFETY
DIVISION OF LAW
25 MARKET STREET
PO Box 112
TRENTON, NJ 08625-0112

PAULA T. DOW
Attorney General

ROBERT M. HANNA
Director

May 4, 2011

Joseph F. Scully, Jr.
Vice President for Finance & CFO
Rowan University
Bole Hall
201 Mullica Hill Road
Glassboro, NJ 08028-1701

Re: Tax Exempt Status of Rowan University
Federal Tax ID #222-764-819

Dear Mr. Scully:

You have asked this office for an opinion whether Rowan University is obligated to pay New Jersey sales and use taxes in the conduct of the University's business.

You are hereby advised that, pursuant to N.J.S.A. 54:32B-9, any sales, service or amusement charge by or to the University or any use or occupancy by the University is not subject to taxes imposed by the New Jersey Sales and Use Tax Act, N.J.S.A. 54:32B-1 et seq., where the University or its authorized representative conducting University business, is the purchaser, user or consumer. Further, should the United States or any other state grant an exemption from certain taxes to the State of New Jersey, Rowan University, as an arm of the State, is entitled to such consideration.

Sincerely yours,

PAULA T. DOW
ATTORNEY GENERAL OF NEW JERSEY

By: Cheryl R. Clarke
Cheryl R. Clarke
Deputy Attorney General

CRC/rd

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Chief Financial Officer
Bole Hall
201 Mullica Hill Road
Glassboro, NJ 08028-1701

856-256-4127
856-256-4443 fax

CONSENT OF SURETY COMPANY TO FINAL PAYMENT

AIA DOCUMENT G707

OWNER ☐
ARCHITECT ☐
CONTRACTOR ☐
SURETY ☐
OTHER

PROJECT:
(name, address)

TO (Owner)

ARCHITECT'S PROJECT NO:

CONTRACT FOR:

CONTRACT DATE:

CONTRACTOR:

In accordance with the provisions of the Contract between the Owner and the Contractor as indicated above, the (there insert name and address of Surety Company)

, SURETY COMPANY,

on bond of (there insert name and address of Contractor)

, CONTRACTOR,

hereby approves of the final payment to the Contractor, and agrees that final payment to the Contractor shall not relieve the Surety Company of any of its obligations to (there insert name and address of Owner)

, OWNER,

as set forth in the said Surety Company's bond.

IN WITNESS WHEREOF,
the Surety Company has hereunto set its hand this day of 2017

Surety Company

Signature of Authorized Representative

Attest:
(Seal):

Title

NOTE: This form is to be used as a companion document to AIA DOCUMENT G706, CONTRACTOR'S AFFIDAVIT OF PAYMENT OF DEBTS AND CLAIMS, Current Edition

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section. In the event of any conflicts between the requirements of these Sections, the more stringent requirement shall apply.

1.2 SUMMARY

A. This Section includes the following:

1. Work covered by the Contract Documents
2. Use of premises.

B. Related Sections include the following:

1. Division 01 Section “Construction Facilities and Temporary Controls” for limitations and procedures governing temporary use of Owner’s premises.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification:

1. Project Location: Rowan University, Glassboro, New Jersey

a. 201 Mullica Hill Road, Glassboro, NJ 08028, Block: 388 Lot: 1

2. Owner: Rowan University

B. Architect Identification: The Contract Documents were prepared for Project by:

1. FIFTEEN Architecture + Design
31 N 2nd Street, 2F
Philadelphia, PA 19106

C. The Work consists of the following:

1. The contractor will be permitted to conduct their building surveys once the letter of award is issued. Contractor shall also begin the submittal process.
2. Contractor must outline in their bid any long lead items that may impact their ability to meet the deadlines of the schedule.
3. Rowan University has submitted the Plans and Specification to DCA for the Plan Review Process.
4. Contract is responsible to submit all permits.
5. Bid shall include all systems improvements as shown on the Wilson Hall Dance Program Expansion Technical Specifications and Design Documents issue under this IFB.
6. Contractor must follow all OSHA and Rowan safety guidelines and procedures.

7. Contractor shall Schedule and Coordinate all work activities with Rowan University.
8. Contractor must bid the project to meet the schedule outlined in the bid documents which may include weekend and/or shift work. Contractor must staff the project accordingly to meet the schedule since the end date is firm. Rowan will not entertain change orders for contractor's inability to meet this schedule or time extensions.
9. Contractor is responsible to schedule and manage all required inspections, including but not limited to Final Certificate of Occupancy inspection.
10. Contractor is required to maintain a clean job site and to turn over the building back to the owner in the condition is was received.
11. Contractor is responsible to perform final cleaning prior to Final Turn Over and Owner's Final Acceptance.

1.4 CONTRACT

A. Project will be constructed under a single prime general construction contract.

1.5 USE OF PREMISES

A. General Construction Operations: Contractor shall have limited use of premises for construction operations, including a limited use of the project site (outside the facilities exterior walls) during the period of construction activity. Contractor's use of the premises is limited by Rowans right to perform work or to retain other contractor's on portions of the Project or to limit access for events or other functions as the University might require. The Contractor will be given notice of any such events well in advance so that arrangements can be made to insure the prosecution of the work continues as scheduled.

B. Arrange use of site and premises to allow:

1. Owner occupancy.
2. Work by others.
3. Work by Owner.

C. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of Project site beyond the building perimeter unless prior approval of the University is received prior to conduction such work or operations.

1. Limit site disturbance, as approved by Rowan University.
2. **REFER TO SECTION 011400 FOR WORK HOURS.**
3. Storage of construction materials and equipment is not permitted inside the existing building.
4. Driveways and Entrances: Keep driveways and entrances serving premises clear and available to Rowan University, Rowans employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

    a. Schedule deliveries to minimize use of the driveways and entrances.
    b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

D. Use of Existing Building: Maintain existing building in a weather tight condition throughout construction period. Repair damage caused by construction operations. Protect building and its occupants during construction period.

E. **The Contractor will be responsible for photographing the entire area of work, adjacent spaces where incidental work may occur, corridors and elevators accessing the area of work, the loading area, and contractor parking area. The Contractor will provide the Owner with digital copies of all the photographs prior to mobilization as a record of the existing conditions PRIOR to the start of the work**. Digital format will be in PDF format.

1.6 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the 48-division format and CSI/CSC's "MasterFormat" numbering system.

1. Section Identification: The Specifications use section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of sections in the Contract Documents.

1.7 MISCELLANEOUS PROVISIONS

A. **WORK REQUIRED TO BE PERFORMED UNDER THIS CONTRACT SHALL BE COMPLETED IN ACCORDANCE WITH THE FOLLOWING MILESTONES AND COMPLETION DATES. CONTRACTORS MUST INCLUDE IN THEIR BIDS ALL COSTS INCLUDING OVERTIME ASSOCIATED WITH INSURING THAT THE PROJECT IS COMPLETED BY THE MILESTONE DEADLINES LISTED HEREIN.**

B. Summary of Milestones:

1. Notice to Proceed/Authorization by: The University intends to issue Notice to Proceed, Construction Contract, and/or University purchase order as evidence of contract award.
2. ALL submittals to Architect: one (1) week after Notice to Proceed.
3. Architect return of reviewed of submittals by: 10 business days after receipt.
4. **Substantial Completion** by As outlined in bid documents**.**
5. Final Completion of work on site by **FIVE (5) BUSINESS DAYS FROM SUBSTANTIAL COMPLETION**. All construction including punch list work will be completed by this date.
6. **Final Completion** by **TEN (10) BUSINESS DAYS FROM SUBSTANTIAL COMPLETION DATE**. All closeout documentation, final payment application, etc.

C. Weather Conditions:

1. Unfavorable weather conditions shall not be justification for delays in completion or final completion dates as specified. No change orders will be issued or approved for extensions of time due to weather conditions. Seasonal weather conditions shall be considered in the planning and scheduling of all work influenced by high or low ambient temperatures for the completion of all contract work within the allotted contract time. In addition, appropriate allowances shall be made for anticipated time losses due to normal rain and snow conditions by statistically expanding the estimated time durations for weather sensitive activities with the constraint that the substantial completion deadline cannot change.
2. The University may at its sole discretion entertain extensions of time from the contractor for weather related delays. However no extensions of time shall be considered by the University until at least twenty-five (25) lost project schedule days have accrued. Lost time will accrue on a proportionate basis – 1/4 lost day will be charged as 1/4 lost day,

1/2 lost day will be charged as 1/2 lost day, and so forth. A lost project schedule day is considered a day or any portion of a day when all members of the construction workforce on the project cannot work due to inclement weather conditions. Whether or not the contractors' workforce fails to begin work or leaves the project site on any given day due to a claim of inclement weather a lost project schedule day will not be recognized by the University until it is approved in writing by the Owner's Project Manager.

3. Should the University approve an extension of time the contractor may only submit reimbursement for the cost of the extension of rental equipment agreements; bond premium and insurance adjustments at actual cost with no mark up; and general conditions directly impacted by the approved extension. Appropriate back up documentation as requested by the Owner's Project Manager must accompany any submission for reimbursement. Appropriate back up can be anything from copies of contractor's rental agreements showing rental durations, unit costs, rental rates, etc. to copies of superintendents pay stubs.

D. Intent of Contract: The drawings and specifications of the contract are intended to require the contractor to provide for everything reasonably necessary to accomplish the proper and complete finishing of the work. All work and materials included in the specifications and not shown on the drawings, or shown on the drawings and not in the specifications, shall be performed and/or furnished by the contractor as if described in both. Any incidental materials and/or work not specified in the drawings and/or the specifications which are, nevertheless, necessary for the true development thereof and reasonably inferable therefrom, the contractor shall understand the same to be implied and required, and shall perform all such work and furnish all such materials as if particularly delineated or described therein. Should there be an obvious error between the drawings and specifications, the most stringent constraints of the conflicting information shall be assumed by the contractor and it shall be the contractor's responsibility to complete the work as reasonably required, consistent with the intent of such drawings and specifications as may be interpreted by the University.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 011000

SECTION 011400 – WORK RESTRICTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section. In the event of any conflicts between the requirements of these Sections, the more stringent requirement shall apply.

1.2 USE OF PREMISES

A. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of site beyond areas in which the Work is indicated.

1. Limits: Confine construction operations to weekdays (Monday through Friday) from 8:00 AM to 5:00 PM. Weekend and Holiday work may be permitted if approved by the Owner.
2. Owner Occupancy: Allow for Owner occupancy of building, site and use by the public.
3. Driveways and Entrances: Keep streets, driveways and entrances serving premises clear and available to owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

a. Schedule deliveries to minimize use of driveways and entrances.
b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

B. Use of Existing Building: Repair damage caused by construction operations. Protect building and its occupants during construction period.

1.3 OCCUPANCY REQUIREMENTS

A. Full Owner Occupancy: Owner will occupy site and existing building during entire construction period. Cooperate with owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations.

1.4 WORK SEQUENCE

A. Work shall be completed within the schedule as outlined in Section 011000 – Summary. University intends to issue Notice to Proceed, Construction Contract, and/or University Purchase Order as evidence of contract award on or before Project start date listed.

1.5 CONTRACTOR WORK AREAS, WORKING CONDITIONS AND EQUIPMENT STORAGE REGULATIONS

A. The Contractor shall not unreasonably encumber the facilities with its equipment or work to be performed. Work conducted by the Contractor, Subcontractor, or any other person and/or firm affiliated with the Contractor shall be contained within pre-designated working areas established by the documents.

B. The Contractor shall, at all times during the progress of the work, keep the site free from the accumulation of all rubbish and debris caused by its performance. The Contractor shall remove all debris and rubbish related to its work at the end of each workday to the satisfaction of the Owner's Project Manager. Tool storage boxes shall not be permitted inside the building on the first floor or outside the building.

C. The Contractor shall adequately secure and protect its equipment, materials and vehicles. The University assumes no liability for any damage to, or theft of, the Contractor's property. The Contractor shall have the use of a designated area for storage and staging of construction materials and equipment. The Contractor shall be responsible for adhering to security procedures outlined by the Owner's Project Manager.

D. The Contractor is responsible for all safety precautions for all of its employees and property while performing its services.

E. The Contractor shall strictly limit its employees' use of the facilities for lunch, smoking or rest time usage to only those areas designated by the Owner's Project Manager. Use of facility telephones will not be allowed. Use of building toilet facilities shall not be permitted. Smoking is not allowed inside the building.

1.6 WORK STOPPAGES, EXISTING UTILITY INTERRUPTIONS, NOISE AND ODOR RESTRICTIONS, AND MATERIAL APPROVALS

A. Work Stoppages – DOES NOT APPLY.

B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Owner not less than five (5) working days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Owner's Project Manager's written permission.

C. Consideration shall be given by the Contractor regarding odors emanating from adhesives and sealants, etc and excessive noise. If the odors or noise are such that they may disturb the employees and guests, then such work shall be performed while the building is not occupied. This determination shall be at the sole discretion of the Owner's Project Manager. The playing of radios and other unnecessary noise will not be permitted at any time.

D. All material safety data sheets shall be submitted and approved by the Owner's Project Manager prior to use of the material.

1.7 PROTECTION OF INTERIOR FINISHES

A. The Contractor shall take extra care to avoid damage or soiling to any part of the facility. The Contractor is responsible for all damages or destruction caused directly or indirectly by its performance to any part of the building or adjoining property. Any damage or destruction caused by the Contractor or its employees will be repaired or replaced as the Owner's Project Manager directs and to their satisfaction with all costs charged to the Contractor. The costs may be deducted from any and all amounts due to the Contractor.

B. Any of the Contractor's employees found defacing, damaging or marring the building or its finishes or contents shall be immediately removed by the Contractor. The Contractor shall

be charged for all remedial work to restore the damaged area or contents to their original condition to the satisfaction of the State.

C. The Contractor shall take all necessary steps to ensure adequate protection of all building furniture, equipment and building finishes, including but not limited to: floors, walls, ceilings, windows, draperies, blinds, carpeting, doors, doorways and contents. In this endeavor, all workers are to take precautions to protect rugs and floors. The Contractor shall be charged for all remedial work to clean, repair and/or replace items damaged by the Contractor to the satisfaction of the State.

D. The Contractor is responsible for the cost of cleanup of dust, dirt and stains caused by the work to the satisfaction of the Owner's Project Manager. The Contractor shall take all necessary precautions to keep dust, dirt and debris to a minimum both within the construction area and throughout the buildings.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 011400

SECTION 01210 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section. In the event of any conflicts between the requirements of these Sections, the more stringent requirement shall apply.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements governing allowances.

1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order Directive **THE ALLOWANCE SHALL BE INCLUDED IN THE BASE BID**.

B. Types of allowances include the following:

1. Lump-sum allowances.

C. Related Sections include the following:

1. Division 01 Section "Quality Control Services" for procedures governing the use of allowances for testing and inspecting.
2. Divisions 02 through 48 Division Sections for items of Work covered by allowances.

1.3 SELECTION AND PURCHASE

A. If applicable, at the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

B. At Architects request and Owners approval, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by Architect from the designated supplier.

1.4 SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

B. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

D. All Allowances will be recorded as separate line items on the initial Schedule of Values to be approved by the Owner and/or Architect. Once the initial Schedule of Values is approved all subsequent Schedule's will continue to include these Allowances as separate line items. Allowances will be tracked as separate line items.

1.5 COORDINATION

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.6 LUMP-SUM ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials and shall include taxes, freight, and delivery to Project site.

B. Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials accepted by Owner under this Section shall be included as part of the allowance.

1.7 UNUSED MATERIALS

A. Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.

1. If requested by Architect, prepare unused material for storage by Owner when it is not economically practical to return the material for credit. If directed by Architect, deliver unused material to Owner's storage space. Otherwise, disposal of unused material is Contractor's responsibility.

1.8 UNUSED ALLOWANCES

A. All unused Allowances are and will remain the Owner's property. The Contractor shall return any remaining Allowance balances to the Owner upon completion of all punch list items and Final Acceptance of the Building.

1. Allowance balances will be returned to the Owner by Change Order.

2. Change Orders for returning Allowance balances to the Owner will be initiated and approved prior to the Contractor submitting for Final Payment. Allowance balances will not be included in the Final Application for Payment.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and

installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

Lump Sum Allowance No. 1, Owner Directed Work: $ [**Enter Numeric Value**] ([**Enter Written Value**] Dollars)

END OF SECTION 012100

SECTION 012200 – UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for unit prices.

B. Related Requirements:

1. Section 012500 “Contract Modification Procedures” for procedures for submitting and handling Change Orders.
2. Section 014000 “Quality Control Requirements” for general testing and inspection requirements.

1.3 DEFINITIONS

A. Unit price is a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.

B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

C. Owner reserves the right to reject Contractor’s measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner’s expense, by an independent surveyor acceptable to Contractor.

D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

A. Refer to “HOURLY LABOR RATE BREAKDOWN” included in Division 01.

END OF SECTION 012200

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section. In the event of any conflicts between the requirements of these Sections, the more stringent requirement shall apply.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.

C. Execute accepted alternates under the same conditions as other work of the Contract.

D. Schedule: A Schedule of Alternates is included at the end of this Section. If specification Sections are referenced in alternate schedule, the specification section contains the requirements for materials necessary to achieve the work described under each alternate. If specifications are not listed in the schedule below, base the alternate price on the description below.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SCHEDULE OF ADD – ALTERNATES

A. Add Alternate No. 1: Removal and replacement of existing AHU-4 and AHU-5 on Level 2 of Wilson Hall, and all work related to this scope, including demolition of units, piping, ductwork, controls, electrical devices, light fixtures, walls, doors, etc. The installation of new mechanical units and new related scope of work including ductwork, piping, controls, lighting, electrical, walls, doors and railing shall be included in Add Alternate #1.

B. Add Alternate No. 2:
Total Square Footage of Planting Area: 1310
See Sheet L-103 for Limits of Work for Add Alternate #2

1. Furnish and install Plants in accordance with the following Plant Schedule.
2. Furnish and install Planting Soil & Planting Amendments in accordance with Specifications as noted for Base Bid.
3. Comply with all Contractor Requirements as noted in Base Bid Specifications.

PLANT SCHEDULE FOR ADD ALTERNATE #2

PLANT TYPE	**QTY**	**SIZE & CONDITION**
Canopy Tree	1	2-2.5” CAL. / B & B, dug in planting season
Understory Tree	3	8-10’ HT/ B & B, multi-stem
Shrub	10	#3 Container, min. 24” HT.
Grass or Sedge	670	“DP50” Deep-rooted Plug
Flowering Perennial	635	“DP50” Deep-rooted Plug

1.

3.2 SCHEDULE OF DEDUCT – ALTERNATES

A. Deduct Alternate No. 1: N/A

END OF SECTION 012300

SECTION 012400 – PROCEDURES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, General Conduct of the Work and Special Requirements, Supplementary Conditions, and other Division 01 Specification Sections, apply to this Section. In the event of any conflicts between the requirements of these Sections, the more stringent requirement shall apply.

1.2 DESCRIPTION OF WORK

A. The types of minimum requirements for procedures and performance or control work of a general nature, to be fulfilled collectively by contractors, include but are not necessarily limited to the following categories:

1. Coordination and meetings.
2. Administration/supervisory personnel.
3. Examination and checking of contract drawings.
4. Surveys and records or reports.
5. Limitations for use of site.
6. Protection of Persons and Property.
7. Special reports.
8. Subcontractor, material approval.
9. Tradesmen and workmanship standards.
10. Inspections, tests and reports.
11. Progress photographs.
12. General installation provisions.
13. Control Wiring.
14. Chases, recesses and openings.
15. Sleeves, built-in items.
16. Cutting and patching.
17. Uncovering and correction of work.
18. Cleaning and protection.
19. Conservation and salvage.

1.3 COORDINATION AND MEETINGS

A. General: Contractor shall prepare a written memorandum of general instructions on required coordination activities including notices/reports/meetings, and distribute memorandum to each engaged entity performing work at project site, with copies to Architect and Owner.

B. Coordination Drawings: Where work by separate entities requires off-site fabrication of products and materials which must be accurately interfaced and closely intermeshed to produce required results, prepare coordination drawings to indicate how work shown by separate shop drawings will be interfaced, intermeshed, and sequenced for installation.

1. Comply with submittal requirements of "Submittals" section, and other requirements outlined in the other Divisions.

C. Biweekly Job Meeting: The Contractor's Project Manager and Superintendent, the Owner's Project Manager and the Architect shall attend biweekly job meetings convened by the Owner for the purpose of affording the opportunity to review Contractor's coordination efforts, to expedite the performance of administrative tasks, and to generally assess the work progress. Contractor shall require representation (at each meeting) by every entity currently involved in coordination or planning for the work (of the entire project). Contractor shall participate in meetings in a manner, which will resolve coordination problems.

1. Time and location of job meetings shall be designated by the mutual agreement of the Contractor, Architect and Owner.
2. Job meetings shall be chaired by the Architect, who shall record the proceedings in the form of minutes and shall be responsible for proper distribution thereof to all parties. Initial minutes will be distributed within three (3) business days after the meeting.
3. Any and all corrections or clarifications to these minutes shall be received by the Architect in writing within three (3) days of their issuance. After the interval allowed for corrections and clarifications, Job Meeting Minutes will stand as part of the project record.
4. All decisions, instructions and interpretations given by Owner, with concurrence of the Architect, at these meetings shall be binding and conclusive on Contractor.
5. Architect and Owner shall have the right to schedule Special Job Meetings or increase the frequency of job meetings if, in his opinion, the progress and condition of the work warrant it. Attendance at such meetings is mandatory.
6. Subcontractors and suppliers shall attend at the request of the Architect or Owner as appropriate to the agenda topics at each meeting.
7. Agenda:

    a. Review of Work progress.
    b. Field observations, problems, and decisions.
    c. Identification of problems, which impede planned progress.
    d. Maintenance of Progress Schedule- updated by Contractor and discussed at every meeting.
    e. Corrective measures to regain projected schedule milestones and deadlines.
    f. Planned progress during succeeding work period and two (2) week look ahead.
    g. Effect of proposed changes on progress schedule and coordination.
    h. Review and update Submittal Log for every meeting.
    i. Other business relating to the Work.

D. Pre-Construction Meeting: Owner will schedule a meeting after Notice of Award.

1. Attendance Required:

    a. Owner.
    b. Architect.
    c. Contractor.

2. Agenda:

    a. Execution of Owner/Contractor Agreement.
    b. Submission of executed bonds and insurance certificates.
    c. Distribution of Contract Documents.
    d. Submission of list of Subcontractors, list of Products, schedule of values, etc.
    e. Procedures and processing of field decisions, submittals, substitutions,

applications for payment, proposal requests, Change Orders, and Contract closeout procedures.

f. Scheduling (Preliminary Progress Schedule by Contractor).

3. The above Agenda is a comprehensive list of items that could be discussed at the Pre- Construction Meeting. Some items will be included while the Owner may choose to handle other items by other means.
4. Architect will record minutes and distribute copies within two (2) days after meeting to participants, with two copies to Contractor, Owner, and those affected by any decisions made.

E. Pre-Installation Conferences:

1. When required by individual specification sections, contractor shall convene a pre-installation conference prior to the start of installation for the portion of work in question.
2. Require attendance of all Subcontractors, suppliers, manufacturers (if necessary), Owner Architect (at the Owners request), Engineers (at the Owners request) directly affecting of affected by the Work in question.

F. Application for Payment “PENCIL COPY” review meeting:

1. Contractor to schedule a Pencil Copy Review Meeting five (5) working days prior to payment period deadline stipulated in the Agreement.
2. Contractor will be responsible to incorporate all agreed upon changes to the Pencil Copy version of the Application and submit the revised Application in accordance with all Contract requirements.

1.4 ADMINISTRATIVE/SUPERVISORY PERSONNEL

A. General: In addition to a Home Office Project Manager and a Field Construction Superintendent and other administrative and supervisory personnel required for performance of the work, the Contractor shall provide specific coordinating personnel as may be required for proper interface between the trades and other work of the total project.

B. Project Superintendent: The Contractor shall provide a full-time Project Superintendent, who is experienced in administration and supervision of building construction of a type similar in nature and scope to this Project, including mechanical and electrical work, and who is hereby authorized to act as the general coordinator of interfaces between the work of all the trades. For purpose of this provision, "interface" is defined to include the scheduling and sequencing of work, sharing of access to work spaces, installations, each trade's protection of work by other trades, cutting and patching, tolerances, preparation of coordination drawings, inspections, tests, and temporary facilities and services.

C. Submittal of Staff Names, Duties: Within 15 days of contract date, the Contractor shall submit to the Owner and Architect a listing of Contractor's principal staff assignments and consultants, naming persons and listing their addresses, telephone numbers and past construction experience.

1.5 EXAMINATION AND CHECKING OF CONTRACT DOCUMENTS

A. Contractor shall be responsible for reviewing the contract documents in accordance with the requirements specified herein.

1. Contractor shall examine and check all quantities and dimensions given on contract drawings, and shall be responsible for noting any errors which can be discovered by such examination and check, and shall be responsible for satisfactory joining and fitting of all parts of the work; any check or observation by Architect/Engineer shall not relieve the Contractor of any responsibility as to correctness of the work.
2. Field verification of dimensions on drawings is specifically directed and required of the Contractor as a matter of course, because locations, distances and elevations will be governed by actual field conditions. Contractor shall review plans, site plans and details of construction on the drawings, and adjust his work to conform to all conditions indicated thereon or reasonably inferable therefrom.
3. Discrepancies shown on different plans and details, or between drawings, and actual field conditions, or between drawings and specifications, shall promptly be brought to the attention of the Architect for interpretation and resolution.
4. If, in Contractor's opinion, any work is indicated on drawings or specified in such a manner as will make it impossible to produce such in conformance with the contact, he shall refer same to Architect for interpretation. If additional and supplementary instructions are necessary, Architect/Engineer will prepare and issue same in an appropriate form to the Contractor, with a copy being forwarded to the Owner.
5. Contractor is directed never to scale dimensions or locations from contract drawings. Consult Architect/Engineer for dimensions and locations of all items.

1.6 SURVEYS AND RECORDS/REPORTS

A. General: Working from lines and levels established by property survey, and as shown in relation to the work, the Contractor shall establish and maintain bench marks and other dependable markers to set lines and levels for the work at each story of construction and elsewhere on site as needed to properly locate each element of entire project. Contractor shall calculate and measure required dimensions as shown (within recognized tolerances if not otherwise indicated); and shall not scale drawings to determine dimensions. Advise tradesmen performing the work, of marked lines and levels provided for their use in layout of work.

1.7 LIMITATIONS FOR USE OF SITE

A. General: It is the intent of the Owner to preserve the present character of the campus to the greatest extent possible, both during and after the period of construction. To this end the Contractor will be subject to certain operational controls in the movement of personnel and equipment on and off the construction site. The Contractor's cooperation with the general goal of protecting and preserving the Institute campus, and with the specific controls specified hereinafter, shall be mandatory. The following general controls shall be observed:

1. Construction activities, including location of temporary support facilities, stockpiling of materials, loading and unloading, parking for construction personnel and other related activities shall be restricted to areas as specified by the Owner.
2. The accumulation or stockpiling of debris, rubbish or other material resulting from demolition or construction operations will not be permitted. Removal and off-site disposal must proceed concurrent with demolition and construction activities, to the end that the site shall at all times present a neat, orderly and workmanship appearance. No liquid or solid material of any kind is to be disposed of on campus property. No burning of trash or debris will be permitted on the site.
3. The Contractor shall be responsible for the prevention, abatement and control of any environmental pollution arising from demolition or construction activities in the performance of the work, in full compliance with all applicable Federal and State laws

and regulations.

a. Existing trees and other vegetation on and adjacent to the project site shall be protected. Refer to Section 015000 - "Temporary Facilities" - for specific requirements concerning fencing. Under no circumstances shall materials be stored or heavy equipment operated beneath the drip lines of existing trees.

4. Contractor shall be responsible for the control of dust arising from demolition or construction operations within the project site or along the Access Routes.

B. Allocation of Space: In addition to site utilization limitations and requirements shown on drawings, and indicated by other contract documents, Contractor shall administer allocation of available space equitably among separate subcontractors and other entities needing access and space, so as to produce overall efficiency in performance of total work of project.

C. Deliveries: Contractor shall schedule deliveries so as to minimize space and time requirements for storage of materials and equipment on site.

D. Construction Access:

1. Contractor shall plan, coordinate and execute all construction activities in such manner as to avoid traffic disruption over local streets.

a. Prior to the start of work, Contractor shall contact the Police Department and determine approved travel routes for delivery vehicles on local streets.
b. Contractor shall obtain and pay for all necessary permits in connection with the operation of overweight and over length vehicles on City streets.

2. Contractor shall be responsible for controlling all traffic entering and leaving the Owner's property including provision of flagmen as necessary. Contractor shall be responsible to require mud removal from rubber-tired vehicles departing the immediate project site. Operation of tracked vehicles shall be restricted to the project site as defined by the contract limit lines, and is not permitted on paved areas.
3. Whenever and wherever the project work must be performed outside the contract limit lines, and after the necessary permits have been secured from local authorities, Contractor shall erect and maintain barricades, danger signals and warning signs at working sites, closed roads, intersections and other places of danger to traffic, the work, or the public. Barricades and obstructions of any kind shall be marked with lights or flares at not more than five (5) foot intervals visible for a distance of not less than 500 feet. Contractor shall provide sufficient watchmen and traffic directors and shall take all necessary precautions for the proper protection of the work and the safety of the public.
4. Contractor shall be responsible for identification, control and maintenance of construction traffic within the contract limit lines. Identification and control shall include the provision of temporary traffic signs and the installation of barricades and warning lights to protect the work and to identify excavations or other hazards, all as may be required. Maintenance shall include the provision and placing of ballast materials as may be required, grading and compaction, removal of debris, removal of snow, and general care to insure a serviceable roadbed at all times.

a. The Owner shall be responsible for snow removal from paved roadways and parking lots in the vicinity of the project area, but not within the work areas or areas immediate to the Contractor's temporary facilities.

5. Prior to final completion, perform all cleaning and repairs as necessary to restore all existing areas within the limits of any and all work required as a part of the scope of these contract documents, to their original condition.

E. Temporary Parking for Construction Personnel: The Owner shall designate available areas for parking.

1. Offsite parking will be available for employee parking, in an area to be designated by the Owner on RUI property. Construction personnel will not be permitted to park in campus parking lots, except as specifically designated and authorized by the Owner. The designated parking area may change due to seasonal demands of the Owner.

F. Staging and Storage Area: The Contractor shall have the authority and responsibility to plan and locate storage areas, equipment marshaling areas, and temporary field facilities. Staging and storage areas shall be so located and utilized as to afford unrestricted access to all of the work at all times. Such areas shall not encroach upon access routes to the work, nor shall they be so located or utilized as to impede free access of emergency vehicles. Such areas must be approved by the Owner prior to use by the contractor.

1. Staging and storage areas shall be located wholly within the contract limit lines and site enclosure fence.
2. All loading and unloading operations shall occur inside the contract limit lines and behind the site enclosure fence.
3. Storage of materials and equipment outside the site enclosure fence or on City streets is absolutely prohibited.
4. Prior to final completion, perform all cleanup, disposal, grading, topsoiling, seeding and other work as necessary to restore the entire staging/storage area to its original condition.

G. Verification of Underground Utilities: Contractor shall have the responsibility to verify the actual locations of existing underground utility lines. Should verified underground utility locations conflict with excavation required in connection with the work, Contractor shall notify the Owner's Project Manager immediately. Hand excavation shall be required at locations in close proximity to verified existing utilities.

1. The Owner does not guarantee the accuracy and completeness of information shown on any contract drawings for underground utilities; Contractor must be responsible for ascertaining all facts concerning utility locations.
2. Damage to existing underground utilities, caused as a result of Contractor's negligence or failure to comply with the requirements listed herein, shall be repaired and/or replaced at Contractor's expense, to the complete satisfaction of the Owner and utility company by close of business of the day of damage.

H. Cleaning and Trash Disposal: Comply with requirements specified in Section 01500, "Temporary Facilities".

1.8 PROTECTION OF PERSONS AND PROPERTY

A. Safety Precautions and Programs: Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the work. He shall designate a responsible member of his organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent, unless otherwise designated by the Contractor, in writing, to the Owner.

B. Protection of Persons: Contractor shall take all necessary precautions for the safety of employees on the work, and shall comply with all applicable provisions of Federal and State safety laws, union safety regulations, and building codes to prevent accidents or injury to persons on, about or adjacent to the premises where the work is being performed. Particular attention is called to the requirements of the Federal Occupational Safety and Health Act (OSHA). In connection with the work of its own forces, Contractor shall direct and properly maintain, at all times, as required by the conditions and progress of the work, all necessary safeguards for the protection of workers and the public and shall post danger signs warning against the hazards created by such features of construction as protruding nails, hoists, well holes, elevator hatchways, scaffolding, window openings, stairways and falling materials.

1. Security/protection provisions are specified in "Temporary Facilities" section.

C. Protection of Work and Property: Contractor shall take all precautions for the safety of, and shall provide all reasonable protection to prevent damage, injury or loss to:

1. All the work and all materials and equipment to be incorporated therein, whether in storage on or off the site, under the care, custody or control of the Contractor or any of his Subcontractors, or Sub-subcontractors; and
2. Other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

a. Refer to "Temporary Facilities" section for specific requirements concerning fencing around existing trees.

D. Emergencies: In any emergency affecting the safety of persons or property, Contractor shall act with diligence, at his discretion, to prevent threatening injury, damage or loss. In such case, he shall immediately notify the Owner, of the action taken and shall forthwith prepare and submit a detailed and documented report to the Owner and the Architect.

E. Insurance and Indemnification: Comply with requirements of the Contract Agreement.

1.9 SPECIAL REPORTS

A. General: Except as otherwise indicated, submit special reports directly to Owner within one day of occurrence requiring special report, with copy to Architect/Engineer and others affected by occurrence.

B. Reporting Unusual Events: When an event of unusual and significant nature occurs at site, the Contractor shall prepare and submit a special report listing chain of events, persons participating, response by Contractor's personnel, evaluations of results or effects, and similar pertinent information. When such events are known or predictable in advance, it is the responsibility of the Contractor to advise the Owner in advance at earliest possible date.

C. Reporting Accidents: Contractor shall prepare and submit reports of significant accidents, at site and anywhere else work is in progress. Record and document data and actions; comply with industry standards. For this purpose, a significant accident is defined to include events where bodily injury is sustained, or property loss of substance is sustained, or where the event posed a significant threat of loss or personal injury.

1.10 SUBCONTRACTOR, MATERIAL APPROVAL

A. Material Approval: Contractor shall submit to the Owner and Architect, for approval, a list of all vendors and manufacturers for the supply of materials and equipment, whether specified or not, starting within fifteen (15) calendar days after award of contract; said list shall be complete within forty-five (45) days thereafter. In instances where specified materials and equipment are subject to the Owner's and Architect's approval by way of the submittal process, no contract shall be entered into with any vendor, supplier or manufacturer before the Owner and Architect have approved his name in writing.

B. Subcontractor Approval: Contractor shall, beginning within fifteen (15) calendar days after award of contract and ending within forty-five (45) days thereafter, notify the Architect and Owner in writing of the names of all subcontractors proposed for the work, and shall not employ any without prior written approval of the Owner, or any that Owner may within a reasonable time reject.

1.11 TRADESMEN AND WORKMANSHIP STANDARDS

A. General: Contractor shall instigate and maintain procedures to ensure that tradesmen performing work at site are skilled and knowledgeable in methods and craftsmanship needed to produce required quality-levels for workmanship in completed work. Remove and replace work, which does not comply with workmanship standards as specified and as recognized in the construction industry for applications indicated. Remove and replace other work damaged or deteriorated by faulty workmanship or its replacement.

B. Availability of Tradesmen: At each progress or job meeting, Contractor shall review availability of tradesmen and projected needs to accomplish work as scheduled. Require each entity employing tradesmen to report on current and pending trade actions and jurisdictional matters, which might affect progress of work. Where possible dispute or delay is identified, consider alternatives and take actions to avoid disputes and delays.

C. Labor Peace Clause:

1. The Contractor agrees that in the performance of the work called for under these Contract Documents, it will employ only such labor as will not delay or interfere with the speedy and diligent progress of the project and as will be acceptable to and work in harmony with all other workmen employed by the Owner.
2. In the event of labor difficulties (including, but not limited to, strikes, walkouts, picketing, boycotts, shutdowns, or inability to obtain a sufficient number of competent laborers or mechanics), which interfere with the work, or any part thereof, it shall be the responsibility of the contractor to take all measures necessary and possible to insure the projects progress and completion as prescribed by the time schedule including, but not limited to, seeking injunctive relief in an appropriate Court of Common Pleas, filing an unfair labor practices charge(s) with the National Labor Relations Board, discharging employees who engage in an unprotected strike or work stoppage, or any other applicable legal or equitable action related to the aforesaid labor difficulty which occurs in connection with the performance of this contract.
3. In the event of a strike or stoppage of work resulting from a dispute involving or affecting the labor employed by the contractor (including subcontractors and suppliers), the Owner may, at its option, terminate this contract. However, where practicable the contractor will give subcontractors 24 hours to resolve the strike or stoppage of work before terminating its contract. In the event there is a conflict between this clause and any other agreement between contractor and the Owner, including but not limited to other provisions of this contract, other written agreements and verbal agreements, this clause will take precedent. In the event of such

termination, the Owner shall have the right to take possession, for the purpose of completing such work, of all materials, tools, and appliances on its premises and employ any person or persons to finish the work and provide the materials and labor for such work. The Contractor shall not be entitled to receive any further payments under this agreement until the work shall be finished completely, at which time the contractor shall be paid whatever balance is found to be due to contractor for amounts expended by it either for labor, materials, or otherwise, plus contractors percentage of profit as provided in this agreement, less, however such expenses or damages as the Owner may suffer by so completing the work. The Contractor shall not be entitled to prospective profits on portions of the project not performed by it or with respect to the materials not furnished by it. Further, it is understood and agreed that should the expenses to the Owner in completing the contract be increased by reason of such discontinuance of the services of this contractor, then this contractor shall be responsible to the Owner for such entire increase in addition to the other expenses or damages referred to above.

1.12 INSPECTIONS, TESTS AND REPORTS

A. General: Required inspection and testing services are intended to assist in determination of probable compliances of the work with requirements, but do not relieve Contractor of responsibility for those compliances, or for general fulfillment of requirements of contract documents. Specified inspections and tests are not intended to limit Contractor's quality control program. Afford reasonable access to agencies performing tests and inspections.

B. Inspection and Testing by Independent Agencies: General requirements are specified in "Quality Control Services" section of these specifications (Section 01400). Particular requirements are specified in the technical sections (Divisions 02 through 48).

C. Inspection and Testing by Authorities with Jurisdiction: If the Contract Documents, laws, ordinances, rules, regulations or order of any public authority having jurisdiction require any portion of the Work to be inspected, tested or approved, the Contractor shall give the Owner not less than five (5) working days notice in writing of its readiness for inspections or testing. The Contractor shall bear all costs of such inspections, tests or approvals conducted by public authorities.

D. Inspection and Testing by Contractors: When inspections and tests are required by the technical sections of these specifications to be performed by Contractors on installed materials and equipment, all such inspections and tests shall be conducted in the presence of, and upon timely notice to, the Owner, and the results thereof approved prior to acceptance of the installation. Fuel, power and any other items or services required for the proper inspecting and testing of equipment and for the period of instructing the Owner's operating personnel shall be at the cost and expense of the Contractor furnishing such equipment.

E. Special Inspection and Testing: If the Owner or Architect/Engineer determines that any Work requires special inspection, testing or approval, not otherwise required herein, he will instruct the Contractor to order such special inspection, testing or approval, and the Contractor shall give notice as provided in subparagraph C. If such special testing or inspection reveals a failure of the Work to comply with the requirements of the Contract Documents, the Contractor shall bear all costs thereof, including compensation for the Architect/Engineer's additional services made necessary by such failure; otherwise the Owner shall bear all costs and an appropriate Change Order will be issued.

1.13 PROGRESS PHOTOGRAPHS

A. Refer to Specification Section 01300, “Submittals” for requirements pertaining to Progress Photographs.

B. Provide photographs of the site and construction throughout progress of Work produced by an experienced photographer or job superintendent experienced in taking construction photographs, acceptable to the Owner.

C. Take photos in a timely fashion to allow for their submission with each application for a payment and/ as follows (as applicable):

1. Installation of site utilities.
2. Installation of footings.
3. Installation of foundations.
4. Building pad proof roll.
5. Building pad sub grade (vapor barrier and stone).
6. Installation of concrete floors, decks, walls, etc.
7. Installation of masonry for stair towers, elevator, exterior walls, etc.
8. Installation of structural steel, steel deck and joist, etc.
9. Rough grading.
10. Installation of parking lot paving, parking lot lighting, line stripping, etc.
11. Installation of interior and exterior framing.
12. Plumbing and electrical rough-ins.
13. HVAC ductwork and units.
14. Installation of telecommunications cabling and devices.
15. Installation of roofing.
16. Installation of windows, doors, hardware, etc.
17. Enclosure of walls and ceilings.
18. Interior and exterior finishes.
19. Installations of millwork, casework, trim work, etc.
20. Landscaping
21. Final Completion.

D. Digital PDFs: Color; three (3) prints of each view. 4” X 8” or larger of each view. Provide enough photos at each stage of construction to give someone not familiar with the Project a clear understanding of the progress of the work. Review photos with the Owner’s representative at each stage of construction requiring photographs. The Owner will determine if additional photos will be needed.

1. PDF format.
2. Identify each print. Identify name of Project, orientation of view, date and time of view.

E. Deliver prints with each Application for Payment or at times specified by Owner with transmittal letter.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION PROVISIONS

A. Pre-Installation Conference: Well in advance of installation of every major unit of work which requires coordination and interfacing with other work, Contractor shall meet at project site with subcontractors, installers and representatives of manufacturers and fabricators who are involved in or affected by unit of work, and in its coordination or integration with other work which has preceded or will follow. Contractor shall advise Owner and Architect of scheduled meeting dates. At each meeting review progress of other work and preparations for particular work under consideration, including requirements of contract documents, options, related change orders, purchases, deliveries, shop drawings, product data, quality control samples, possible conflicts, compatibility problems, time schedules, weather limitations, temporary facilities, space and access limitations, structural limitations, governing regulations, safety, inspection and testing requirements, required performance results, recording requirements, and protection. Contractor shall record significant discussions of each conference, and agreements and disagreements, along with final plan of action. Distribute record of meeting promptly to everyone concerned, including Architect/Engineer and Owner.

1. Do not proceed with the work if associated pre-installation conference cannot be concluded successfully. Instigate actions to resolve impediments to performance of the work, and reconvene conference at earliest date feasible.

B. Installer's Inspection of Conditions: Require Installer of each major unit of work to inspect substrate to receive the work, and conditions under which the work will be performed, and to report (in writing to Contractor) unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

C. Manufacturer's Instructions: Where installations include manufactured products, comply with manufacturer's applicable instructions and recommendations for installation, to whatever extent these are more explicit or more stringent than applicable requirements indicated in contract documents.

D. Inspect each item of materials or equipment immediately prior to installation, and reject damaged and defective items.

E. Provide attachment and connection devices and methods for securing work properly as it is installed; true to line and level, and within recognized industry tolerances if not otherwise indicated. Allow for expansions and building movements. Provide uniform joint widths in exposed work, organized for best possible visual effect. Refer questionable visual-effect choices to Architect for final decision.

F. Recheck measurements and dimensions of the work, as an integral step of starting each installation.

G. Install work during conditions of temperature, humidity, exposure, forecasted weather, and status of project completion, which will ensure best possible results for each unit of work, in coordination with entire work. Isolate each unit of work from non-compatible work, as required to prevent deterioration.

H. Coordinate enclosure (closing-in) of work with inspections and tests, so as to minimize necessity of uncovering work for that purpose.

I. Mounting Heights: Except as otherwise indicated, mount individual units of work at industry-recognized standard mounting heights, for applications indicated. Refer questionable mounting height choices to Architect/Engineer for final decision.

3.2. The contractor shall include in his/her proposal the cost of all control wiring and its installation for all mechanical equipment including, but not limited to, heating, ventilating and air conditioning systems, ATC systems, boilers, remote monitoring systems, etc. which systems require electrical control wiring. The contractor shall employ a sub-contractor approved by the University for all such control wiring. The sub-contractor shall provide a final certificate of electrical inspection of the control wiring. Installed or control wiring must connect to a point of electrical power supply as shown on the contract documents.

3.3 CHASES, RECESSES AND OPENINGS

A. Contractor shall build chases, recesses, openings, channels and flues, and shall leave or create holes where shown on drawings, or where directed for piping, electrical conduits, switchboxes, panelboards, flues and ducts, or any other feature of the mechanical and electrical work. All trades requiring chases, recesses, openings, etc. shall furnish to the Contractor, complete detailed drawings for all chases, recesses and openings required in connection with such work in ample time to allow the construction to proceed without interruption or delay. Comply with requirements of "Submittals" section of these specifications.

1. Contractor shall close, build in and finish around or over all chases, recesses, openings, etc. after installation of mechanical and electrical work has been completed. Should any fail to furnish the above required information in time, he shall, at his own expense, arrange for all cutting, rebuilding, patching and finishing, but shall employ the Contractor whose work must be cut to do so.
2. Contractor shall obtain prior written approval from the Architect/Engineer and the Owner before cutting or boring through beams, floor construction or supporting members.

3.4 SLEEVES, BUILT-IN ITEMS

A. Each trade shall be responsible for furnishing and setting of sleeves, built-in items, anchors, inserts, etc. for his work. Contractor shall build these items into the construction.

1. Comply with requirements of "Submittals" section in the preparation of sleeve drawings.

3.5 CUTTING AND PATCHING

A. General: Do not cut-and-patch structural work in a manner resulting in reduction of load-carrying capacity or load/deflection ratio; submit proposed cutting and patching to Architect/Engineer for structural approval before proceeding. Do not cut-and-patch operational elements and safety-related components in a manner resulting in reduction of capacities to perform in manner intended or resulting in decreased operational-life, increased maintenance, or decreased safety. Do not cut-and-patch work which is exposed on exterior or exposed in occupied spaces of building, in a manner resulting in reduction of visual qualities or resulting in substantial evidence of cut-and-patch work, both as judged solely by Architect. Remove and replace work judged by Architect to be cut-and-patched in a visually unsatisfactory manner.

1. Contractor shall do all cutting, fitting, adjusting and patching as may be required to permit the several parts to properly come together as intended and indicated.
2. Engage original Fabricator/Installer to perform cutting-and-patching of structural work, operational/ safety-related components, and visually exposed work; or, if not

available, engage only recognized experts; employ only proven methods.

3. Do not cut or alter work performed under separate contracts without the Architect's written permission.
4. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specific requirements and methods needed for proper performance of the work of this Section.
5. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Beginning new work means acceptance of existing conditions.
6. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
7. Examine and verify specific conditions described in individual specification sections.
8. Verify that utility services are available, of the correct characteristics, and in the correct locations.
9. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

B. Materials: Except as otherwise indicated or approved by Architect/Engineer, provide materials for cutting-and-patching which will result in equal-or-better work than work being cut-and- patched, in terms of performance characteristics and including visual effect where applicable. Use materials identical with original materials where feasible and where recognized that satisfactory results can be produced thereby.

C. Temporary Support and Protection: Provide adequate temporary support for work to be cut, to prevent failure. Do not endanger other work. Provide adequate protection of other work during cutting-and-patching, to prevent damage; and provide protection of the work from adverse weather exposure.

D. Cut work using methods least likely to damage work to be retained and work adjoining.

1. Where physical cutting action is required, cut work with sawing and grinding tools, not with hammering and chopping tools. Core drill openings through concrete work. Comply with the requirements of applicable sections of Division 02 where cutting-and-patching requires excavating and backfilling.
2. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
3. At penetrations of fire rated walls, partitions, ceilings, or floor construction, completely seal voids with fire rated materials in accordance with Section 07841 to full thickness of the penetrated elements.
4. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

E. Patch with seams, which are durable and as invisible as possible. Comply with specified tolerances for the work.

1. Where feasible, inspect and test patched areas to demonstrate integrity of work.

F. Restore exposed finishes of patched areas; and, where necessary extend finish restoration onto retained work adjoining, in a manner, which will eliminate evidence of patching.

1. Where patch occurs in a smooth painted surface, extend final paint coat over entire unbroken surface containing patch, after patched area has received prime and base

coats.

G. Execute cutting and patching including excavation and fill to complete the work, to uncover work to install improperly sequenced work, to remove and replace defective or non-conforming work, to remove samples of installed work for testing when requested, to provide opening in the work for penetrations of mechanical and electrical work, to execute patching to complement adjacent work, and to fit Products together to integrate with other work.

H. Execute work by methods to avoid damage to other work, and which will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original conditions.

I. **ALL CUTTING AND PATCHING SHALL BE CONSIDERED PART OF THE BASE BID PRICE WHEN THE WORK IS REQUIRED AS PART OF THE OVERALL PROJECT. NO ADDITIONAL PAYMENT WILL BE CONSIDERED FOR WORK OF THIS SECTION UNLESS ALL APPLICABLE PARTIES OBTAIN PRIOR AUTHORIZATION OR WRITTEN APPROVAL.**

3.6 UNCOVERING AND CORRECTION OF WORK

A. Comply with requirements of the General Conditions of the Contract, and with additional requirements specified herein.

1. Subsequent Disclosure of Faulty Work: Failure of Owner or Architect/Engineer to exercise powers of rejection or condemnation against the work of the Contractor during construction shall not be construed as an acceptance on Owner's part or Architect/ Engineer's part that Contractor's work has been faithfully performed, if the fact be otherwise.

3.7 PROJECT CONDITIONS

A. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

B. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

C. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and air from discharge of noxious, toxic substances, and pollutants produced by construction activities. Comply with all governmental and code requirements.

3.8 PREPERATION FOR CUTTING AND PATCHING AND/OR NEW WORK.

A. Prepare surfaces and remove surface finishes to provide for proper installation of work and finishes.

B. Clean substrate surfaces prior to applying next material or substance.

C. Seal cracks or openings of substrate prior to applying next material or substance.

D. Apply manufacturers required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.9 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Owner's Representative and Architect of any discrepancies discovered.

C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

D. Promptly report to Architect/Engineer and Owner's Representative the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

E. Utilize recognized engineering survey practices.

F. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:

1. Site improvements including but not limited to pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations, etc.
2. Building foundation, column locations, all floor elevations, stairwells, elevator shafts, machine and mechanical rooms, etc.
3. All other work as necessary to complete all the requirements of the contract documents.

G. Periodically verify layouts by same means.

H. Maintain a complete and accurate log of control and survey work as it progresses.

3.10 GENERAL INSTALLATION REQUIREMENTS

A. Install Products as specified in individual sections and in accordance with manufacturer's recommendations.

B. Make neat transitions. Patch work to match adjacent work in texture and appearance. Where new Work abuts or aligns with existing, perform a smooth and even transition.

C. When existing finished surfaces are cut so that a smooth transition with new Work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendations to the Architect and Owner.

3.11 CLEANING AND PROTECTION

A. General: During handling and installation of work at project site, Contractor shall clean and protect work in progress and adjoining work on a basis of perpetual maintenance. Apply suitable protective covering on newly installed work where reasonably required to ensure freedom from damage or deterioration at time of substantial completion; otherwise, clean and perform maintenance on newly installed work as frequently as necessary through remainder of construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

B. Removal of all debris and rubbish resulting from or relating to the construction work; rubbish shall not be thrown from building openings above the ground floor unless confined within chutes.

1. Progress Cleaning:

    a. Maintain areas free of waste material, debris, and rubbish (on a daily basis). Maintain site in a clean and orderly condition, as determined by the Owner.
    b. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
    c. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
    d. Collect and remove waste materials, debris, and rubbish from site periodically and dispose of off-site.
    e. Protect installed work and provide special protection where specified in individual specification sections.
    f. Provide temporary and removable protection for installed Products. Control activity during and after installation in the immediate work area to prevent damage.
    g. Protect finished floors and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials appropriate for the task involved.

C. Limiting Exposures of Work: To extent possible through reasonable control and protection methods, Contractor shall supervise performance of work in a manner and by means which will ensure that none of the work, whether completed or in progress, will be subjected to harmful, dangerous, damaging, or otherwise deleterious exposures during construction period. Such exposures include (where applicable, but not by way of limitation) static loading, dynamic loading, internal pressures, external pressures, high or low temperatures, thermal shock, high or low humidity, air contamination or pollution, water, ice, solvents, chemicals, light, radiation, puncture, abrasion, heavy traffic, soiling, bacteria, insect infestation, combustion, electrical current, high speed operation, improper lubrication, unusual wear, misuse, incompatible interface, destructive testing, misalignment, excessive weathering, unprotected storage, improper shipping/handling, theft and vandalism.

D. Construction Debris: The Contractor shall intermittently remove waste and rubble so that at no time shall there be undue accumulations. Upon completion, the Contractor shall dress up all areas affected by this work whether inside or outside the boundary of the Project. Loading, crating, hauling and dumping will be at the contractor's expense.

E. Rubbish: The Contractor shall provide covered metal trash cans in sufficient quantity to accept the accumulation of rubbish and garbage from lunch and the like of employees of all Contractors working on site.

    1. The Contractor shall instruct his and his subcontractors' employees to deposit their trash and garbage in these containers and not elsewhere about the site; and also not to use the containers for construction scraps, rubbish, trash and surplus materials.
    2. The Contractor shall empty these containers daily and haul the rubbish to a legal disposal site off the property.

F. Roads and Pathways:

    1. The Contractor is responsible for the removal of construction dirt and debris in public areas on the site and in the surrounding areas serving the site.
    2. Dirt and mud tracked onto streets by the Contractor or its subcontractors is to be immediately cleaned up by the Contractor to the satisfaction of the Owner and the local municipal authorities.

G. Trucks: All trucks leaving the construction area are to be covered in accordance with NJDOT over the road requirements. Trucks leaving the site are to be clean and free of mud or other materials.

H. Quality Assurance: University streets and pathways are to be maintained in a clean safe condition at all times. Under no circumstances shall the Contractor leave the site each day without inspecting and verifying that streets and paths to the construction site, access areas, lay down areas, and gates in the area of the site are clean of all construction related materials and are clean and sage for use by the Rowan University population. The Contractor will immediately correct any violation of this provision upon notification by the Owner.

3.12 CONSERVATION AND SALVAGE

A. General: It is a general procedural requirement for Contractor's supervision and administration of the work that construction operations be carried out with maximum practical consideration for conservation of energy, water and materials; and with maximum practical consideration for salvaging materials and equipment involved in performance of the work but not incorporated therein.

END OF SECTION 012400

SECTION 012500 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section. In the event of any conflicts between the requirements of these Sections, the more stringent requirement shall apply.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.

B. Related Sections include the following:

1. Division 01 Section "Allowances" for procedural requirements for handling and processing allowances.
2. Division 01 Section "Unit Prices" for administrative requirements for using unit prices.
3. Division 01 Section "Product Requirements" for administrative procedures for handling requests for substitutions made after Contract award.

1.3 MINOR CHANGES IN THE WORK

A. Architect may issue through Owner's Project Manager supplemental instructions authorizing Changes in the Work, not involving adjustment to the Contract Time, as "Architects Supplemental Instructions" (ASI). Architects Supplemental Instructions may or may not involve adjustments to the contract sum. THERE WILL BE NO ADJUSTMENTS TO THE CONTRACT TIME ALLOWED FOR THIS PROJECT.

1. For ASI's involving no adjustment to the contract sum or time, the contractor is authorized to execute the change or clarification immediately.
2. For ASI's resulting in an adjustment to the contract sum, do not consider them instructions either to stop work in progress or to execute the proposed change without obtaining written authorization from the Owner. Written authorization can include the provisions of the general conditions, Article 14, paragraphs 14.5.3 and 14.7.1, an approved change order or a Construction Change Directive.

1.4 PROPOSAL REQUESTS

A. In the event the Contractor believes that any change directed by the Owner or Architect would entitle it to additional compensation to complete its work under this contract, **the Contractor shall immediately notify the Owner's Project Manager of this fact WITHIN 48 HOURS OF RECEIPT OF THE CHANGE REQUESTED**. The contractor shall then prepare and submit an original of the Change Order Request (COR) with all supporting documentation to the Owner's Project Manager and submit two (2) copies of the Change Order Request (COR) with all supporting documentation to the Architect and University within five (5) calendar days of its receipt of the directive by the Owner and/or Architect.

B. Owner-Initiated Proposal Requests: Owner may issue proposal requests or may have the

Architect issue such requests. In any event a detailed description of proposed changes in the Work will be submitted to the contractor that may require adjustment to the Contract Sum. THERE WILL BE NO ADJUSTMENTS TO TIME FOR ANY GIVEN CHANGE ORDER REQUESTED. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Proposal Requests issued by Architect are for information only. For ASI's resulting in adjustments to the contract sum, do not consider them instructions either to stop work in progress or to execute the proposed change without first obtaining written authorization from the Owner.
2. If the contractor feels the ASI or proposal request requires a change to the contract sum then the contractor shall notify the Owner's Project Manager of this fact within 48 hours of receipt of the ASI or OIPR directive.
3. Within five (5) business days after receipt of directive, ASI or proposal request from the Owner, submit a Change Order Request estimating cost adjustments to the Contract Sum necessary to execute the change. The contractor shall then prepare and submit an original of the Change Order Request (COR) with all supporting documentation to the Owner's Project Manager and submit two (2) copies of the COR with all supporting documentation to the architect.

    a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    b. Indicate applicable delivery charges, equipment rental, and amounts of trade discounts.
    c. Include costs of labor directly attributable to the change.

        1) Labor shall be broken down by man-hours, hourly wages, fringe benefits per hour and any other benefits payable.

    d. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float however the date of Substantial and Final Completion cannot be extended.

C. In the event that the Contractor encounters a condition that it considers a change, the Contractor shall immediately notify the Owner's Project Manager prior to disturbing the condition and shall then prepare and submit an original of the COR with all supporting documentation to the Owner's Project Manager and two (2) copies of a Change Order Request with all required supporting documentation to the architect within five (5) calendar days of encountering the condition. The condition shall not be disturbed until the Owner's Project Manager has inspected the condition.

D. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a Change Order Request (COR) to Owner's Project Manager. The contractor shall prepare and submit one (1) original of the COR with all supporting documentation to the Owner's Project Manager and submit two (2) copies of the COR with all supporting documentation to the architect.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.

3. Indicate applicable delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float however the date of Substantial and Final Completion cannot be extended.
6. Comply with requirements in General Conditions Article 4.15 if the proposed change requires substitution of one product or system for product or system specified.

E. Proposal Request Form: Use AIA Document G709 for Proposal Requests.

1.5 ALLOWANCES (**IF APPLICABLE ON A GIVEN PROJECT**)

A. Allowance Adjustment: To adjust allowance amounts, base each Allowance Request Proposal on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins. **Only allowances included as part of the Bid Price will be considered for an Allowance Authorization. All other Proposals must be hard costed.**

1. Include installation costs in purchase amount only where indicated as part of the allowance.
2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to allowances.
4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the Purchase Order amount or Contractor's handling, labor, installation, overhead, and profit. Submit claims within ten (10) business days of receipt of the Change Order or Construction Change Directive authorizing work to proceed. Owner will reject claims submitted later than ten (10) business days after such authorization.

1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
2. No change to Contractor's indirect expense is permitted for selection of higher- or lower- priced materials or systems of the same scope and nature as originally indicated.

C. ***Use the same procedure(s) followed for handling Change Order Requests (COR's) and Change Orders with Allowances (except use Allowance Forms rather than Change Order Forms).***

1.6 CHANGE ORDER PROCEDURES

A. Upon the Owner's approval of a Change Order Request (COR), the Owner will direct the Architect to issue a Change Order for signatures of the Contractor and Owner on AIA Document G701.

1. The Change Order breakdown shall be in sufficient detail to permit an analysis of all

material, labor, equipment, sub-contract and overhead costs as well as profit. Any amount proposed for sub-contracts shall be supported by a similar price breakdown.

B. Each Change Order must contain a detailed description of the change and the amount by which the Contract Price will be increased or decreased.

C. COMPUTATION OF ADDITIONAL COMPENSATION

1. In connection with any request for additional compensation the Contractor shall furnish a price breakdown, as follows:

    a. Labor shall be broken down by the man-hour, hourly wages, fringe benefits per hour and any other benefits payable by the Contractor;
    b. Materials shall be broken down by quantity and unit prices.

2. Unless otherwise directed, the breakdown shall cover all work involved in the change whether such work was deleted, added or changed.
3. The breakdown shall be in sufficient detail to permit an analysis of all material, labor, equipment, sub-contract and overhead costs as well as profit. Any amount proposed for sub-contracts shall be supported by a similar price breakdown.
4. The following rates shall apply in computing indirect costs and profit for the negotiation of additional compensation under all provisions of this contract, which provide for such adjustments that do not exceed twenty-five thousand dollars ($25,000.00). The resulting change in the contract amount will include the indirect impact cost of extended performance computed in accordance with the terms of this article and no further consideration of such costs arising from the specific modification will be given. The percentages for overhead and profit shall be negotiated and may vary according to the nature, extent and complexity of the work involved. If not negotiated prior to the start of construction then the rates herein designated shall apply. The percentages shall be applicable for deleted work as well as additional work. When a change consists of both added and deleted work, the applicable percentages shall be applied to the net cost or credit. In any event, the percentages shall not exceed the sum of the following:

    a. Overhead will be the sum of ten percent (10%) of direct labor costs.

        1) For the purpose of the article, the term direct labor shall include all labor by contractor's employees necessary to perform the actual work on site. Foremen, equipment operators and skilled, semi-skilled and common laborers directly assigned to the specific operation are direct labor; project managers, superintendents, office personnel, and subcontractors are not direct labor.
        2) The term direct labor costs shall consist of the contract or actual payroll rate of wage per hour and fringe benefits paid for each and every hour that such employees are actually engaged in the performance of the work. Overhead will be the sum of ten percent (10) % of direct material costs.

    b. Overhead will be the sum of ten percent (10%) of direct material costs.

        1) For the purpose of the article, the term direct material costs shall consist of the actual costs of the materials, including applicable tax and transportation charges
    c. For rented equipment, an hourly rental rate will be used which will be determined by using the monthly rental rates taken from the current edition of

the rental rate blue book for construction equipment and dividing it by one hundred seventy-six (176). An allowance will be made for operating costs for each and every hour the equipment is actually operating in accordance with the rate listed in the aforesaid rental book. The contractor will be allowed only sixty-five percent (65%) of the rental rate on contractor owned equipment.

d. Bond premiums, insurance, payroll taxes and travel subsistence, if applicable, will be allowed at actual cost (only) for the equitable adjustment allowed. No mark-up will be allowed for overhead on these indirect cost items.

e. The contractor's profit on the sub-contractor's work will be five percent (5%) of the sub-contractor's costs. Sub-contractor indirect costs will be computed in the same manner as for the contractor. The contractor agrees to incorporate this article in each of it sub-contracts.

f. A profit of six percent (6%) where profit is allowable by the terms of the applicable contract provision shall be added to the contractor's total cost for the equitable adjustment allowed for the work conducted by the contractors own workforce. Indirect costs will not be duplicated in direct costs.

g. When more than one (1) tier of sub-contractors exists, they shall be treated as one (1) sub-contractor for the purpose of mark-ups.

D. ANY CONTRACTOR PERFORMING CHANGE ORDER WORK WITHOUT **WRITTEN** APPROVAL FROM THE OWNER DOES SO AT ITS OWN RISK.

1. Only the signature of an Assistant Vice President or above is authorized to give approval of a Change Order Request (COR) or Change Order (CO). The Owner's Project Manager is not authorized to approve change orders. The Owner's Project Manager is only authorized to verify the work in question is in addition to or outside the scope of work delineated on the original contract documents.

1.7 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect at the direction of the Owner's Project Manager may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost adjustments to the Contract.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PERFORMANCE OF CHANGE ORDER WORK

A. A contractor who performs any scope of work associated with a change order or allowance (if allowances are applicable on a given project) without receiving proper approval in accordance with all contract document requirements hereof does so at its own risk. The

Contractor shall have waived any and all claims for additional compensation related to said changes or conditions encountered.

END OF SECTION 012500

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section. In the event of any conflicts between the requirements of these Sections, the more stringent requirement shall apply.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Sections include the following:

1. Division 01 Section "Allowances" for procedural requirements governing handling and processing of allowances.
2. Division 01 Section "Unit Prices" for administrative requirements governing use of unit prices.
3. Division 01 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
4. Division 01 Section "Construction Progress Documentation" for administrative requirements governing preparation and submittal of Contractor's Construction Schedule and Submittals Schedule.

1.3 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.

1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:

a. Application for Payment forms with Continuation Sheets.
b. Submittals Schedule.

2. Submit the Schedule of Values submission to Architect and Owners Construction Manager in accordance with the general conditions and general conduct of work.

3. Sub schedules: Where the Work is separated into phases requiring separately phased payments, provide sub schedules showing values correlated with each phase of payment.

B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the Schedule of Values:

    a. Project name and location.
    b. Name of Architect.
    c. Architect's project number.
    d. Contractor's name and address.
    e. Date of submittal.

2. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:

    a. Related Specification Section or Division.
    b. Description of the Work.
    c. Name of subcontractor.
    d. Name of manufacturer or fabricator.
    e. Name of supplier.
    f. Change Orders (numbers) that affect value.
    g. Dollar values
    h. Cost totals.

        1) Percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate.

    a. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed.

4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.

5. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

    a. Differentiate between items stored on-site and items stored off-site.
    b. The University may, in its sole discretion, pay the Contractor for material delivered on the site and preparatory work done to be taken into consideration. Material delivered to the contractor at locations other than the site may also be taken into consideration if (1) such consideration is specifically authorized by the contract and (2) the contractor furnishes a form entitled "Contractor's Summary of Stored Materials" and agreement and bill of sale certification, respectively, for stored materials and (3) the contractor furnishes evidence of insurance for said materials or a bonded warehousing agreement.

6. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.

7. Allowances: Provide a separate line item in the Schedule of Values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities. Allowances will only be accepted for items listed in the Bid Documents.

8. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

    a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place must be shown as separate line items in the Schedule of Values.

9. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

    a. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.

1.5 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.

1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
2. Submit three (3) copies of each Application for Payment, at least five (5) business days prior to the actual submission date as specified. This Application will be reviewed and adjusted by all parties (Architect, Owner and Contractor) at a "**PENCIL COPY REVIEW"** meeting prior to final approval.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.

C. Payment Application Times: The date for each progress payment is per the General Conditions. The period covered by each Application for Payment starts on the day following the end of the preceding period and ends 15 days before the date for each progress payment.

D. Payment Application Forms: Use AIA Document G702 and AIA Document G703 Continuation Sheets

E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Owner's Project Manager will return incomplete applications without action.

1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

F. Transmittal: Submit 3 (three) signed and notarized original copies of each Application for Payment to Owner's Project Manager by a method ensuring receipt within 24 hours. All

copy's shall include 'Attachment to G702- Certification for Payment", Release of Liens Forms (included in the Contract Documents) entirely completed for the contractor, all subcontractors and anyone else whose payment is listed in the Schedule of Values for the application being requested, AIA G706 A-Contractors Affidavit…, Certified Payrolls and Monthly Work Force Reports, updated and current Construction Schedule, updated and current Submittal Log, and current Project Photograph's.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

G. Release of Mechanic's Lien: With each Application for Payment, submit partial or final releases of mechanic's lien (as may apply) from every entity that is lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.

1. Submit partial waivers on each item for amount requested, before deduction for retainage, on each item.
2. When an application shows completion of an item, submit final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Submit final Application for Payment with or proceeded by final waivers from every entity involved with performance of the Work covered by the application that is lawfully entitled to a lien.
5. Release Forms: Submit release of lien on forms, executed in a manner acceptable to Owner. (Use Form listed in Division 0 of the Specifications).

H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of Values.
3. Contractor's Construction Schedule (preliminary if not final).

    a) A final schedule must be submitted prior to Owners payment of the second (2^{nd}) progress payment.

4. Products list.
5. Schedule of unit prices.
6. Submittals Schedule (preliminary if not final).
7. List of Contractor's staff assignments.
8. List of Contractor's principal consultants.
9. Copies of building permits.
10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
11. Initial progress report.
12. Report of preconstruction conference.
13. Certificates of insurance and insurance policies.
14. Performance and payment bonds.
15. Data needed to acquire Owner's insurance.
16. Initial settlement survey and damage report if required.
17. Current construction photographs as specified herein.

I. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

J. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
6. AIA Document G707, "Consent of Surety to Final Payment."
7. Evidence that claims have been settled.
8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
9. Final, liquidated damages settlement statement.

K. When Owner or Architect/Engineer requires substantiating information, submit data justifying dollar amounts in question. Provide one (1) copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

1. Any other information or documentation required by other provisions of the contract documents shall be supplied.

L. In order to be proper an Application for Payment must include the following as applicable:

1. Total amount, payee name and address, department/agency, payee declaration, payee reference number and identification number.
2. contract number, contractor’s name, period of the Application, completion date, number of sheets, amount due this period, amount to date, retainage, certification by payee, certification signed by the Project Manager and Architect and approval of payment signed by the contracting officer or his/her designee, previous payment requests, total deductions and additions.
3. In making progress payments for work, the University will retain ten percent (10%) of the approved invoice of payment until final acceptance and completion of all work covered by the contract.
4. After fifty percent (50%) of the work has been completed, upon written request by the contractor and provided the contracting officer determines that the contractor's performance and progress have been satisfactory, the University will make partial payments thereafter in full of the approved payment amount. If, however, progress is not maintained in accordance with the approved schedule, the contracting officer may elect to reinstitute retainage of ten percent (10%) of amounts due to the contractor. The contracting officer shall have the sole authority to determine whether contractor’s performance and progress warrant waiver of ten percent (10%) retainage.

M. Upon acceptance and completion of each building or other clearly definable severable portion of the contract work for which the price is stated separately within the contract, payment may be made in full at the discretion of the contracting officer including retained percentages thereon less authorized deductions.

N. All authorized Applications are to be sent to the Owners authorized representative at the address provided at the pre-construction conference. Receipt shall start the prompt payment clock unless returned to the contractor for correction within thirty (30) calendar days after receipt. Reference section 10.2.4 (d) of the General Conditions.

1.6 FINAL PAYMENT

A. Upon final acceptance, the amount due the contractor under this contract shall be paid upon satisfactory completion by the contractor of all contract close-out requirements as required by the University, completion of a University audit on all contract values and payments and after the contractor shall have furnished the University with a final release of liens from the contractor and all subcontractors, sub-subcontractors, vendors, suppliers and any other entity affiliated with the contractor for completion of this project of any and all claims against the University arising by virtue of this contract other than claims in stated amounts as may be specifically excepted by the contractor from the release.

B. Upon satisfying the above conditions, the contractor shall submit a properly executed Application for Final Payment to the University through the Owner's Project Manager. The University Controller shall date stamp the Application. This action by the University Controller shall constitute receipt of a properly executed State invoice application.

C. If, for any reason, the contractor refuses final payment, the project shall be closed-out by the University unilaterally processing a final acceptance certificate. The University will hold all residual funds in escrow until all claims of the University and all contractors are satisfied.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 012900

SECTION 013100 – COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, General Conduct of the Work and Special Requirements, Supplementary Conditions, and other Division 01 Specification Sections, apply to this Section. In the event of any conflicts between the requirements of these Sections, the more stringent requirement shall apply.

1.2 SUMMARY

A. This Section includes administrative and supervisory requirements necessary for coordinating construction operations including, but not necessarily limited to, the following:

1. General project coordination procedures.
2. Conservation.
3. Coordination Drawings.
4. Administrative and supervisory personnel.
5. Cleaning and protection.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 01 Section "Field Engineering" specifies procedures for field engineering services, including establishment of benchmarks and control points.
2. Division 01 Section "Submittals" for preparing and submitting the Contractor's Construction Schedule.
3. Division 01 Section "Contract Closeout" for coordinating contract closeout.

1.3 COORDINATION

A. Coordinate construction operations included in various Sections of these Specifications to assure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in the sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.
3. Make provisions to accommodate items scheduled for later installation.

B. The mechanical. electrical and fire protection drawings are diagrammatic only and are not intended to show the alignment, physical locations or configurations of such work. Such work shall be coordinated by the Contractor and shall be installed to clear all obstructions, permit proper clearances for the work of other trades, satisfy all code requirements and present an orderly appearance where exposed a t no additional cost to the Owner.

C. Where necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.

1. Prepare similar memoranda for the Owner and separate contractors where coordination of their work is required.

D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and assure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Prepare and coordinate scheduling, delivery and processing of submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
2. Verify that utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
3. Coordinate space requirements, supports, and installation of mechanical and electrical work, which are indicated diagrammatically on the Drawings. Follow routing shown for pipes, ducts and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance and for repairs.
4. Installation and removal of temporary facilities.
5. Progress meetings.
6. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
7. Coordinate completion and clean-up of work of separate sections.
8. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.
9. Project closeout activities.

E. Conservation: Coordinate construction operations to assure that operations are carried out with consideration given to conservation of energy, water, and materials.

1. Salvage materials and equipment involved in performance of, but not actually incorporated in, the Work.

1.4 SUBMITTALS

A. Coordination Drawings: Prepare coordination drawings where careful coordination is needed for installation of products and materials fabricated by separate entities. Prepare coordination drawings where limited space availability necessitates maximum utilization of space for efficient installation of different components.

1. Show the relationship of components shown on separate Shop Drawings.
2. Indicate required installation sequences.
3. Comply with requirements contained in Section "Submittals."

a. Note the coordination drawing submittal requirements under Section 013300

"Submittals", paragraph 2.3.9

B. Staff Names: Within fifteen (15) days of commencement of construction operations, submit a list of the Contractor's principal staff assignments, including the superintendent and other personnel in attendance at the Project Site. Identify individuals and their duties and responsibilities. List their addresses and telephone numbers.

1. Post copies of the list in the Project meeting room, and the temporary field office.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL COORDINATION PROVISIONS

A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

B. Coordinate temporary enclosures with required inspections and tests to minimize the necessity of uncovering completed construction for that purpose.

3.2 CLEANING AND PROTECTION

A. Clean and protect construction in progress and adjoining materials in place, during handling and installation. Apply protective covering where required to assure protection from damage or deterioration at Substantial Completion.

B. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to assure operability without damaging effects.

C. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

END OF SECTION 013100

SECTION 013200 – CONSTRUCTION PROGRESS SCHEDULE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions (Contract Administration Division Section D), General Conduct of the Work and Special Requirements, and other Division 01 Specification Sections, apply to this Section. In the event of any conflicts between the requirements of these Sections, the more stringent requirement shall apply.

1.2 SUBMITTALS

A. Within three (3) days after the date established in the Notice to Proceed, University Contract and/or purchase order submit preliminary schedule indicating the scope of work for the duration of the project. A Gantt chart format will be acceptable however the final approved schedule must be in both a Gantt chart and CPM schedule format. If another method other than CPM is used the critical path and float time must be established and programmed into the schedule.

B. Initial Working CPM Schedule Submittal: To the extent necessary for the Contractor to reflect in the arrow diagram the plan for completion of this contract, the contractor shall meet with and furnish all necessary information for the preparation of the scheduling system within ten (10) calendar days after award of this contract. This information shall include, but not necessarily be limited to, logical sequencing of work operations; activity time estimated, intended crew flow, activity costs and estimated manpower requirements of each activity.

1. The contractor shall be responsible to reflect all sub-contractor work as well as his/her own work in proper coordinated sequence on the network diagram. The contractor shall be prepared to meet as many times as necessary with the Owner's Project Manager for the timely development of the project schedule.

1.3 SCHEDULE FORMAT

A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number. At a minimum provide the following.

1. Include a separate bar for each portion of work or operation.
2. Identify the first workday of each week.
3. Identify each critical path task or portion of work.
4. Identify task durations, predecessors and dependent tasks.
5. Identify milestone dates for completion/start of each critical path element.

B. The contractor shall utilize the earliest scheduled start and finish dates in planning, coordinating and performing the work under this contract including all activities of sub-contractors, equipment vendors and suppliers.

PART 2 - PRODUCTS – NOT USED

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 CONTENT

A. Construction logic and activity time durations shall be established by the contractor subject to approval by the Owner's Project Manager consistent with contract requirements and reflective of proper coordination between trades.

B. The Owner's Project Manager shall establish the specific level of detail to be reflected in the scheduling system.

C. Seasonal weather conditions shall be considered in the planning and scheduling of all work influenced by high or low ambient temperatures for the completion of all contract work within the allotted contract time. In addition, appropriate allowances shall be made for anticipated time losses due to normal rain and snow conditions by statistically expanding the estimated time durations for weather sensitive activities with the constraint that the substantial completion deadline cannot change.

D. The coordinated combined Progress Schedule the Contractor will develop shall incorporate the schedules of all Prime Contractors engaged on the project. The Schedule shall be in a form as specified herein and elsewhere in the contract documents and in sufficient detail to satisfy the Architect/Engineer and the University.

E. If applicable, the Contractor shall submit copies of his initial draft of this Schedule to all Prime Contractors. Each Prime Contractor shall then prepare a Progress Schedule for his own work, properly coordinated with the General Construction Contractor's initial draft and then submit it to the General Construction Contractor for his preparation of the final draft of a Single Coordinated Progress Schedule. Contract Requisitions will not be processed by the University until and unless such a single coordinated Progress Schedule shall have been submitted to and approved by the Owner's Project Manager and/or Contracting Officer. This submission shall be no later than thirty (30) colander days after the award of the Contract. If any Prime Contractor delays his submission, the Project Schedule will be submitted without his input and any payments otherwise due him will be withheld until he complies.

F. The Progress Schedule based upon the Contractor's logic and time estimates shall indicate, in suitable detail for display, all significant features of the Work of each Contractor, including the placing of orders and anticipated delivery dates for critical items and all other critical path activities, submissions and approvals of Shop Drawings, all work activities to be performed by each Contractor and the beginning and time durations thereof, float time and the dates of substantial and final completion of the various branches of the Work.

1. Show complete sequence of construction activity, with dates for beginning and completion of each element of construction.
2. Identify each item by specification section number or per bid form breakdown.
3. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.
4. Indicate delivery dates as milestones for Owner-furnished items and any critical path items.
5. Provide legend for symbols and abbreviations used.
6. Show critical path tasks; differentiate them from other construction tasks.
7. Schedule will be based upon a five-day workweek.

3.2 REVIEW AND EVALUATION OF SCHEDULE

A. Review and Approval of Initial Working Schedule: Within ten (10) calendar days after receipt of the initial arrow diagram and computer produced schedule, the University's representative shall meet with the contractor and for joint review, correction or adjustment of the proposed plan and schedule to evaluate the cost values assigned to each activity. Within ten (10) calendar days after the joint review, the Contractor will revise the arrow diagram and the computer- produced schedule in accordance with agreement reached during the joint review and shall submit two (2) copies each of the revised arrow diagram, computer produced schedule and cost requisition to the University. The resubmission will be reviewed by the University and, if found to be as previously agreed upon, will be approved. An approved copy of each will be returned to the Contractor. The contractor shall review the schedule to insure that it reflects all changes agreed to and, if all changes have been made, the contractor shall approve and sign the network diagrams, computer produced schedule and cost requisition listing at that time. Approval will be without reservation and the contractor will be deemed to have accepted the schedule as adequate, proper and binding in all respects and shall not raise objections to the schedule. After the network diagrams, computer-produced schedule and cost requisition listing have been signed, the Contractor shall forward one (1) set of signed copies of all scheduling documents to the Owner’s Project Manager. The arrow diagram and the computer-produced schedule with approved signatures shall constitute the project work schedule until subsequently revised in accordance with the requirements of this section.

B. Evaluate project status to determine work behind schedule and work ahead of schedule. Submit revised recovery schedule with action plan to bring “behind schedule” tasks and milestones back into original timeline.

3.3 UPDATING SCHEDULES

A. Maintain schedules to record actual start and finish dates of completed activities.

1. Updated schedules must be submitted at each progress meeting and with each application for payment or as required by Architect or Owner. These schedules must include the following:

    a. approved changes in activity sequencing;
    b. changes in activity durations for unstarted or partially completed activities where agreed upon;
    c. the effect to the network of any delays in any activities in progress and/or the impact of known delays, which are expected to affect future work;
    d. the effect of contractor modifications; i.e., activity durations, logic and cost estimates; to the network;
    e. changes to activity logic where agreed upon to reflect revision in the contractor's work plan; i.e., changes in activity duration, cost estimates and activity sequences for the purpose of regaining lost time or improving progress;
    f. changes to milestones, and due dates (except substantial completion) which have been agreed upon by the University since the last revision of the schedule.

B. At the same time the network is updated, the contractor and the University's representative shall jointly make entries on the preceding network diagram schedule to show actual progress, to identify those activities started by date and those completed by date during the previous period to show the estimated time required to complete each activity started but not yet completed, to show activity percent completed and to reflect any changes in the arrow diagram approved in accordance with the preceding paragraph. After completion of the joint

review and the University's approval of all entries, the Contractor will submit updated network diagrams and an updated computer produced calendar dated schedule to the University and the contractor.

1. The resultant computer print-out and network diagrams shall be recognized by the contractor as solely his/her updated construction schedule to complete all remaining contractor work except that portion affected by interim University decisions.

3.4 DISTRIBUTION OF SCHEDULES

A. Upon approval at each level of schedule development (preliminary, final for Contractors work and Single Coordinated including all Prime Contractors work) the Contractor shall prepare and distribute (10) copies of the schedule at each level to the University. The Contractor shall also prepare and distribute two (2) copies of the final schedule showing Prime Contractors work to each Prime Contractor. In the event a new Prime Contractor is added to the job the General Construction Contractor shall furnish a revised schedule immediately with copies as indicated. The final coordinated schedule shall be signed and dated by all Prime Contractors involved and shall become part of the contract documents.

B. Distribute copies of updated (current) schedules to Contractors project site file, subcontractors, suppliers, Architect and Owner at each bi-weekly progress meeting. Also submit an updated (current) schedule with each Application for Payment or more often as required by the Architect and/or Owner.

3.5 SCHEDULE ADJUSTMENTS

A. Upon Owner and/or Architects request, if Contractor falls behind the approved schedule, the Contractor must submit a revised schedule to show how the Contractor intends to accomplish the completion of the work within the original contract time.

1. Within seven (7) days after receipt of notice from the Owner, the contractor shall submit to the University in writing an explanation of corrective action taken or proposed. The contracting officer shall make a decision binding on all parties after reviewing the written submissions.

B. Responsibility for Completion: The contractor agrees that whenever it becomes apparent from the current monthly computer produced calendar dated schedule that any contract completion date will not be met, he/she will take some or all of the following actions at no additional cost to the University.

1. increase construction manpower in such trades and numbers as will substantially eliminate the backlog of work in the opinion of the Construction Manager and contracting officer
2. increase the number of working hours per shift, shifts per working days, working days per week or the amount of construction equipment of any combination of the foregoing sufficiently to substantially eliminate the backlog of work in the judgment of the Construction Manager and contracting officer
3. reschedule activities to achieve maximum practical concurrence of accomplishment of activities

C. Lost time due to weather conditions will not accrue nor be credited to Contractor for weather delays with time added to the Substantial Completion milestone deadline. No weather delays will be granted once the building is under roof.

3.6 BI-WEEKLY REPORTING

A. Upon request from the Owner, the Contractor shall furnish for approval, his proposed operating schedule for the next immediate two-week period of time. This schedule will be submitted at each bi-weekly progress meeting along with the overall updated schedule.

1. Every two (2) weeks, the Architect will conduct a coordination and scheduling meeting on the job site. At this meeting, the contractor shall provide detailed information in the form of a bar chart schedule regarding the work schedule to be performed during the upcoming two (2) weeks. Bi-weekly scheduling by the contractor shall be in accordance with the priorities and degree of concurrent work required by the official schedule for the project. The contractor shall be prepared to explain a difference between the contractor's bi-weekly schedules and the priorities required by the latest updating of the official schedule.
2. At the bi-weekly scheduling meeting, the Owner and Architect shall review the bar charts for the preceding two (2) weeks and the contractor shall report the progress actually achieved for each activity, which was scheduled to be performed during the two (2) weeks, including the actual dates on which the work was performed. The contractor agrees that this information shall constitute the official historical record of project progress. At each bi-weekly scheduling meeting, the contractor shall document any current delays to work operations. In addition, the contractor shall provide any available information regarding any potential delays, which they anticipate; i.e., procurement delays, expected strikes, etc.
3. Following the bi-weekly scheduling meeting, the Contractor shall issue to the Owner and Architect a new set of bi-weekly bar charts as developed at the meeting, which shall constitute the construction schedule for the upcoming two (2) weeks. The Contractor shall also issue a narrative bi-weekly progress analysis documenting progress achieved during the preceding two (2) weeks and analyze delays reported to constitute current or anticipated impacts to timely construction. The revised bar chart schedule and progress narrative shall agree with the meeting minutes and items discussed and agreed to at the bi-weekly meeting.
4. The contractor shall be represented at the bi-weekly scheduling meeting by their Construction Manager who shall have complete authority to provide the information required for the development of the next two (2) weeks bar chart schedule, documentation of past progress and documentation of delays. The contractor representatives shall also be authorized to discuss correction action planned to overcome delaying conditions at these meetings.

3.7 DAILY REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at the Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events (refer to special reports).
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.

15. Construction Change Directives received and implemented.
16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Partial Completions and occupancies.
19. Substantial Completions authorized.

B. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents prepare and submit a detailed report. Submit with requests for interpretation. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

END OF SECTION 013200

SECTION 013300 SUBMITTAL PROCEDURES

PART 1 - PRODUCTS

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, General Conduct of the Work, Supplementary Conditions, and other Division 01 Specification Sections, apply to this Section. In the event of any conflicts between the requirements of these Sections, the more stringent requirement shall apply.

1.2 SUMMARY

A. This Section augments requirements set forth in the General Conditions and specifies administrative and procedural requirements for submittals required for performance of the Work, including:

1. Contractor's Use of Architect's CAD Files.
2. Shop Drawings.
3. Product Data.
4. Samples.
5. Informational Submittals.
6. Delegated Design.

B. Administrative Submittals: Refer to General Conditions, other Division 01 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to:

1. Permits.
2. Contractor's Construction Schedule.
3. Submittal Schedule.
4. Schedule of Values.
5. Applications for payment.
6. List of Subcontractors.

C. Related Sections include the following:

1. Division 01 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes and for submitting Coordination Drawings.
2. Division 01 Section "Quality Requirements" for submitting test and inspection reports and for mockup requirements.
3. Division 01 Section "Closeout Procedures" for submitting warranties.
4. Division 01 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.
5. Division 01 Section "Demonstration and Training" for submitting videotapes of demonstration of equipment and training of Owner's personnel.
6. Divisions 2 through 48 Sections for specific requirements for submittals in those Sections.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information that requires Architect and Construction Manager's responsive action.

B. Informational Submittals: Written information that does not require Architect and Construction Manager's responsive action. Submittals may be rejected for not complying with requirements.

C. Concurrent Review: Simultaneous review by Architect and other discipline(s).

D. Shop Drawings: Original fabrication drawings.

E. Product Data: Manufacturer's standard product literature and samples.

1.4 SUBMITTAL PROCEDURES

A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

B. Submittals Schedule: Comply with General Conditions and other requirements of the Contract Administration Division. A submittal schedule will be developed by the Contractor within 10 working days of Notice to Proceed and approved by the Architect within 10 working days after receipt for review.

1. **Follow the submittal requirements listed in this Section and elsewhere throughout the Contract Documents however and in addition to submittals required in other specification sections, one (1) copy of all HVAC, sprinkler, plumbing, electrical, and control system submittal must be forwarded to the Owner's Project Manager. At minimum, for submittals other than those listed under this item a transmittal must be forwarded to the Owner's Project Manager.**

C. Contractor shall record all submittal information on the required "Submittal Log". Distribute Log at each progress meeting.

D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 10 working days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.

2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 5 working days for review of each resubmittal.
4. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 10 working days for initial review of each submittal. Submittal will be returned to Contractor, through Architect. Submittals in the following sections require concurrent consultant review:

    a. Division 03: All Sections.
    b. Division 05: Sections 05120 “Structural Steel”, 05310 “Steel Deck”, 05300 “Steel Joists.
    c. Division 09: Acoustic Sections
    d. Division 13: All Sections.
    e. Division 15: All Sections.
    f. Division 16: All Sections.

5. Concurrent Transmittal to Consultant: Where indicated above and acceptable to Architect, Contractor may transmit submittals directly to Architect’s consultants in the required number of copies, while at the same time transmitting two additional copies of the entire submittal including the transmittal to the Architect.
6. Concurrent Transmittal to Owner:

    a. Transmit two (2) additional copies of all shop drawings, product data and coordination drawings and coordination drawings and one (1) set of each sample submittal to Owner’s Project Manager.

E. Identification: Place a permanent label or title block on each submittal for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 4 by 5 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Include the following information on label for processing and recording action taken:

    a. Project name.
    b. Date.
    c. Name and address of Architect.
    d. Name and address of Contractor.
    e. Name and address of subcontractor.
    f. Name and address of supplier.
    g. Name of manufacturer.
    h. Submittal number or other unique identifier, including revision identifier.

        1) Architect will assign own numbers to each submittal, which may be different than those assigned by the Contractor.

    i. Number and title of appropriate Specification Section, and Keynote reference where applicable.
    j. Drawing number and detail references, as appropriate.
    k. Other necessary identification.

F. Deviations: Encircle or otherwise specifically identify deviations from the Contract Documents on submittals.

1. No deviation or substitutions will be considered without a credit value, and subsequent

approval from the Owner's Project Manager.

G. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

1. Submit specified number of copies of submittal to concurrent reviewer in addition to one complete copy and transmittal to Architect.
2. Additional copies submitted for maintenance manuals will not be marked with action taken and will be returned.

H. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without review, received from sources other than Contractor.

1. Transmittal Form: Provide locations on form for the following information:

a. Project name.
b. Date.
c. Destination (To:).
d. Source (From:).
e. Names of subcontractor, manufacturer, and supplier.
f. Category and type of submittal.
g. Submittal purpose and description.
h. Specification Section number and title.
i. Drawing number and detail references, as appropriate.
j. Submittal and transmittal distribution record.
k. Remarks.
l. Signature of transmitter.

2. On the transmittal record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including minor variations and limitations. Include Contractor's Certification that information complies with Contract Document requirements.

I. Contractor's Certification: All scale and full-size shop, erection or setting drawings, roughing drawings, sleeve and opening drawings, product data, and samples shall be examined and checked by qualified technical employees of Contractor as to accuracy, completeness and compliance with all contract documents prior to submission to the Architect for his review. These drawings, data and samples shall be stamped and signed by Contractor certifying to such examination and compliance. Any drawings, data and samples not checked, stamped, and signed by Contractor will be returned unchecked, to Contractor. Contractor will be held responsible for any delay in the progress of the work due to his failure to observe these requirements, and the time for the completion of his contract will not be extended on account of his failure to submit drawings, data and samples promptly in accordance herewith.

J. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked "No Exceptions Taken", or "Make Corrections Noted".

K. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, and authorities having jurisdiction, and others as necessary for performance of construction activities. Furnish one (1) copy of final submittals to Owner. Show distribution on transmittal forms.

L. Use for Construction: Use only final submittals with mark indicating "No Exceptions Taken" or “Make Corrections Noted” by Architect.

M. In instances where sepias, shop drawings and/or erection of drawings of a scale larger than the contract drawings are prepared by a contract, such drawings and sepias will be accepted in lieu of marked-up contract drawings provided they are updated according to the contract documents. A master sheet of the same dimensions as the contract drawings shall be prepared by the contractor on a tracing which shall indicate, sheet by sheet, a cross-reference to all shop drawings pertaining to that drawing. All drawings and sepias as required by Section 2.8 F below, shall be labeled "as-built" and dated above the tile block.

1.5 CONTRACTOR'S USE OF ARCHITECT'S CAD FILES

A. General: Architect may provide electronic copies of CAD files of the Contract Drawings for Contractor’s use in preparing submittals subject to execution by the Contractor of a waiver and payment to the Architect for this service in the amount of $250. In accordance with the language of the waiver, the agreement is non-transferable by the Contractor to any Subcontractor, from any Subcontractor to the Contractor or from any Subcontractor to another Subcontractor. A separate waiver and payment is required for each individual contractor or subcontractor requesting electronic copies of CAD Drawings.

1. A sample copy of the waiver is included at the end of this Section. Upon request, Architect will provide an original.
2. This service is not available prior to the award of the contract.
3. Architect’s consultants may or may not provide CAD files under the above agreement. Such consultants reserve the right to refuse to provide CAD files, regardless of whether or not the aforementioned waiver and fee agreement is executed. Consultants may, if they agree to provide CAD files, attach additional conditions to those listed above and below. Architect’s consultants include the following disciplines: civil, landscape, structural, mechanical, electrical, plumbing, and fire protection. Architect will advise Contractor if any consultants will not provide CAD files prior to executing above agreement.
4. CAD files will be provided in AutoCad 2002 format or newer version only.
5. CAD files will be provided in Architect’s office standard conventions for file structure, file names, layering standards, drafting standards, etc. Architect will not make revisions to these standards for the convenience of the Contractor.
6. CAD files may or may not contain differences from the Contract Documents, including work and information related, but not limited to, alternate designs, obsolete designs, addenda, bulletins, construction sketches, and informational sketches. Such differences may or may not be clearly indicated. Where such differences are found, they do not supersede the Contract Documents.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.

B. When the following are specified in individual sections, submit them for review:

1. Shop drawings.
2. Samples for selection.
3. Samples for verification.
4. HVAC Test and Balance Reports.

C. Submit to Architect for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.

D. Architect will consult with the Owner prior to rendering a decision or approval.

2.2 PRODUCT DATA

A. Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

a. Manufacturer's written recommendations.
b. Manufacturer's product specifications.
c. Manufacturer's installation instructions.
d. Standard color charts.
e. Manufacturer's catalog cuts.
f. Wiring diagrams showing factory-installed wiring.
g. Printed performance curves.
h. Operational range diagrams.
i. Mill reports.
j. Standard product operation and maintenance manuals.
k. Compliance with specified referenced standards.
l. Testing by recognized testing agency.
m. Application of testing agency labels and seals.
n. Notation of coordination requirements.

4. Submit Product Data before or concurrent with Samples. Each item of materials listed shall be marked “as specified” or “unspecified” as the case may be.
5. Number of Copies: Submit one original and three copies. For color charts submit four original color charts. One original and one copy will be returned. Reproduction for distribution to subcontractors, manufacturers, fabricators and suppliers is the responsibility of the Contractor.

a. Concurrent Submittals to Consultants: Submit one original and three copies to concurrent reviewer and two copies to Architect. In the case of color charts and other non-reproducible information, submit four originals to concurrent reviewer and two original to Architect.
b. Concurrent Submittals to Owner: Submit one (1) copy.
c. Copy Owner with any transmittals for Product data sent to Architect or Consultants.

2.3 SHOP DRAWINGS:

A. Shop Drawings:

1. Shop Drawings are required all new work. Do not use Shop Drawings without an appropriate final stamp indicating action taken.
2. Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
3. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

    a. Dimensions.
    b. Identification of products.
    c. Fabrication and installation drawings.
    d. Roughing-in and setting diagrams.
    e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
    f. Shopwork manufacturing instructions.
    g. Templates and patterns.
    h. Schedules.
    i. Design calculations.
    j. Compliance with specified standards.
    k. Notation of coordination requirements.
    l. Notation of dimensions established by field measurement.
    m. Relationship to adjoining construction clearly indicated.
    n. Seal and signature of professional engineer if specified.
    o. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.

4. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 36 by 48 inches.
5. Number of Copies: Submit one original (Contractor's option of bond print or correctable translucent reproducible print) and three additional copies. One original and one copy will be returned. Reproduction for distribution to subcontractors, manufacturers, fabricators and suppliers is the responsibility of the Contractor.

    a. Concurrent Submittals: Submit one original and three copies to concurrent reviewer and two copies to Architect.
    b. Concurrent Submittals to Owner: Submit one (1) copy to Owner
    c. Copy Owner with any transmittals for Product data sent to Architect or Consultants.

6. Special Types of Shop Drawings:

    a. Sleeve and Opening Drawings: Comply with requirements set forth in the General Conditions.

        1) Comply with shop drawing requirements for submittal and review as specified in this Section.

    b. Roughing Drawings: Furnish manufacturers certified roughing drawings, indicating accurate locations and sizes of all service utility connections, for machinery and equipment requiring such connections. Submit roughing drawings together with shop drawings for respective machinery and equipment.

7. Mechanical/Electrical Shop Drawing Minimum Requirements: Shop Drawings prepared by mechanical specialty trades shall comply with the following minimum requirements:

    a. The accurate dimensions locate all horizontal ducts from column centerline. Locate all offsets, transitions, elbows, fire dampers, registers, grilles and diffusers.
    b. All components shall be located to avoid recessed lighting, piping, conduits, cable trays and other in-plenum assemblies and where required shall be located so as to provide access to the component through removable ceiling material panels or access doors.
    c. Vertical riser ducts shall be located and dimensioned from column centerlines in two (2) directions. Each vertical duct riser shall be shown in its total length when concealed inside of a shaft.
    d. Each horizontal duct run shall be drawn to scale and size (width and depth noted) and an ELEVATION (bottom of duct) be clearly noted. This elevation shall clear all beams in the floor above and the ceiling construction below.
    e. Sheet metal shop drawings shall be made using not less than ¼" scale per foot; increase scale as required in congested areas or as directed by the Contractor.

8. All piping, including fire protection, storm, sanitary, domestic, heating and cooling systems.

    a. Give location of lines from column centerlines, indicate size, indicate centerline ELEVATION of piping and indicate drainage pitch as required.
    b. Where a piping line is indicated locate centerline ELEVATION and pitch at intervals not to exceed twenty (20) feet.
    c. Priority status shall be accorded preparation of dimensioned piping drawings for all piping below slabs-on-grade. Show all line pitches, critical inverts, in-slab fixtures as drains, floor sinks, troughs, cleanouts, etc. and outfall tie-in to site plumbing. Coordinate under slab piping with arrangement(s) of equipment furnished by others where applicable.

9. Electrical Trade:

    a. Plan layouts, not less than ¼" scale, of transformer vaults, main electrical rooms, satellite electrical and/or communications closets, emergency generator spaces showing equipment to scale and locations thereof.
    b. Main feeder distribution routing, horizontal and vertical sweep transitions to scale, of conduit over 1" showing ceiling plenum to scale.

10. Coordination:

    a. Coordination of the work of the several trades and the fitting and routing of the systems within concealed areas to avoid conflicts is the responsibility of the contractor(s). The Architect reserves the right to request coordinated drawings of congested areas showing all systems in plan and section to appropriate scale to insure the proper fitting of the work. The Contractor shall comply if so requested by the Architect.
    b. Provide coordinated drawings of all main mechanical, electrical, communications, and other rooms listed below showing equipment required by all trades including structure, piping, hanger assemblies, HVAC ductwork, conduit, electrical devices, fire alarm devices, control centers, pipe grids, acoustic enclosures, other devices. Drawings dimensioned in both plan and section(s); not less than 3/8"=1’-0” scale.

2.4 COORDINATION DRAWINGS

A. Prepare and submit Coordination Drawings where close and careful coordination is required for installation of products and materials fabricated off-site by separate entities, and where limited space availability necessitates maximum utilization of space for efficient installation of different components. See paragraph 2.3.9 above.

1. Show the interrelationship of components shown on separate Shop Drawings.
2. Indicate required installation sequences.
3. Refer to "General Provisions" Sections for specific Composite Drawing requirements for mechanical and electrical installations.

B. Role of Expediter: Contractor shall be responsible for expediting the preparation of the Coordination Drawings. Actual preparation of the drawings is described below. Contractor shall meet with subcontractors to develop a format for the Coordination Drawings (e.g. CAD, pin-register drafting, conventional drafting on Mylar using multiple pencil colors, etc.) such that reproductions obtained from the final Coordination Drawings can distinguish between the work of the various trades. Contractor shall resolve all conflicts arising in the coordination process.

C. Preparation Responsibility: Preparation of Coordination Drawings is the responsibility of the Contractor and all subcontractors principally involved. Production of the drawings shall proceed as follows:

1. HVAC subcontractor shall initiate the drawings by indicating his work, drawn at a scale of 3/8" per foot, showing dimensions, layouts, elevations and sections, all in relation to building construction (all steel structure, floor / roof slabs, ceilings, beams and columns).
2. Where applicable, the GWB subcontractor shall indicate the layout of all acoustic ceiling construction extent including all hanger devices and locations. AC ceiling construction indicated as well.
3. Fire Protection subcontractor shall then indicate the layout, sizes, dimensions and elevations of his work, using the HVAC subcontractor's drawings as a base, with dimensions in reference to fixed building construction.
4. Electrical subcontractor shall add his work to the base drawings begun by HVAC and Fire Protection subcontractors. Indicate locations and dimensions of light fixtures and electrical equipment conduit/cable-tray infrastructure, fire alarm equipment with reference to fixed building construction.
5. Plumbing subcontractor shall then add layouts, sizes and elevations of his work to the drawings of the above-mentioned trades, also dimensioned with reference to building structure.

D. Conflicts arising between the work of several trades shall be resolved between the respective trades, with the assistance of the General Contractor as expediter; and the drawings revised. Final Coordination Drawings shall be submitted by the Contractor to the Architect as required for submittals.

2.5 SAMPLES:

A. Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:

    a. Generic description of Sample.
    b. Product name and name of manufacturer.
    c. Sample source.
    d. Number and title of appropriate Specification Section.

3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

    a. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

    a. Number of Samples: Submit three full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

    a. Number of Samples: Submit four sets of Samples. Architect will retain one Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a Project Record Sample.

        1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
        2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

2.6 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections.

1. Number of Copies: Submit two copies of each submittal, unless otherwise indicated. Architect will not return copies.
2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. An officer shall sign certificates and certifications or other individual authorized to sign documents on behalf of that entity.
3. Test and Inspection Reports: Comply with requirements specified in Division 01 Section "Quality Requirements."

B. Coordination Drawings: Comply with requirements specified in Division 01 Section "Coordination."

C. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names.

D. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

E. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

F. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

G. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

H. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

I. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

J. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

K. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

L. Schedule of Tests and Inspections: Comply with requirements specified in Division 01 Section "Quality Requirements."

M. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

N. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

O. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

P. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."

Q. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

R. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:

1. Preparation of substrates.
2. Required substrate tolerances.
3. Sequence of installation or erection.
4. Required installation tolerances.
5. Required adjustments.
6. Recommendations for cleaning and protection.

S. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

T. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

2.7 DELEGATED DESIGN

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit three copies of a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

2.8 ADMINISTRATIVE SUBMITTALS

A. Contractor's Construction Schedule: Comply with the General Conditions and other requirements of the Contract Administration Division.

1. If preliminary schedule requires revision after review, submit revised schedule within 5 business days.

2. Submit updated schedule with each Application for Payment.

B. Submittals Schedule: Comply with the General Conditions and other requirements of the Contract Administration Division.

1. Submit updated Submittal Log with each Application for Payment.

C. Application for Payment: Comply with the General Conditions and other requirements of the Contract Administration Division.

D. Schedule of Values: Comply with the General Conditions and other requirements of the Contract Administration Division.

E. Subcontract List: Comply with the General Conditions and other requirements of the Contract Administration Division. Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.
4. Number of Copies: Submit three copies of subcontractor list, unless otherwise indicated. Architect will return two copies.

a. Mark up and retain one returned copy as a Project Record Document.

5. Submit one (1) copy of initial subcontractor list to Owner within (10) business days

after Owner's Notice to Proceed. No portion of the work shall be started until the Contractor has furnished the Owner with a list showing the sub-contractor and/or material supplier responsible for the portion of the actual work needing to be started. The list will be updated until the list reflects the complete group of all subcontractors, suppliers, vendors, etc. employed to carry out the work.

F. The contractor shall keep one (1) set of drawings on the project at all times which are to be marked "as-built". During the course of the project, they shall mark these drawings with colored pencils to reflect any changes as well as dimension, the location of all pipe runs, conduits, traps, footing depths or any other information not already shown on the drawings or differing there from. All buried utilities outside the building shall be located by a metes and bounds survey performed by a licensed surveyor who shall certify as to its accuracy. These marked-up drawings and surveys shall be made available to the contracting officer, the Construction Manager and the Architect/Engineer at any time during the progress of the work upon their request. These shall include the drawings of principal sub-contractors as well. The Owner's Project Manager as well as the Architect on a monthly basis as a prerequisite to the review of the contractor's payment applications will review as-built drawings.

2.9 SUBMITTALS FOR PROJECT CLOSE OUT

A. When the following are specified in individual sections, submit them at project closeout:

1. Project record documents.
2. Operation and maintenance data
3. Warranties.
4. Bonds (if and when required by the Owner).
5. Other types as indicated.

B. Manufacturers' Instructions, Product Literature, Certificates, and Reports.

1. All instructions, literature, certificates, test reports, other technical data and correspondence shall be submitted in four (4) copies. The Owner shall retain Two (2) copies, and the other two (2) returned to the Contractor.

C. Written Certifications

1. Provide written certifications where required, in the following formats:

a. Manufacturer's Written Certifications: Shall be submitted in letter form on the manufacturer's letterhead, signed by an authorized representative, indicating that all required components and elements of their manufacture are in conformity with the requirements so stated under the individual sections of these Specifications. Technical data, additional support material, or other information may be submitted with the certification letter.
b. Installer's Written Certifications: Shall be submitted in letter form on the installer's company letterhead, signed by a legal authorized company officer, indicating that their respective installation and/or Work are in conformity with the requirements so stated under the individual sections of these Specifications.

D. Submit all of the above items in this Section for the Owner's benefit during and after project completion.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect. The Architect / Consultants will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:

1. Final Unrestricted Release: When submittals are marked “No Exceptions Taken” (NET), that part of the Work covered by the submittal may precede provided it complies with requirements of the Contract Documents; final acceptance will depend upon compliance.
2. Final-But-Restricted Release: When submittals are marked “Make Corrections Noted” (MCN), that part of the Work covered by the submittal may precede provided it complies with notations or corrections on the submittal and requirements of the Contract Documents; final acceptance will depend on that compliance.
3. Returned for Resubmittal: When submittal is marked “Amend and Resubmit” (AR), do not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat if necessary to obtain a different action mark.

    a. Do not permit submittals marked “Amend and Resubmit” to be used at the Project site, or elsewhere where Work is in progress.

4. Disapproved for Non-Compliance: When submittal is marked “Rejected - See Remarks” (R), Architect’s explanation for rejection will be included. Do not proceed with the work. Prepare a completely new submission.
5. Other Action: Where a submittal is primarily for information or record purposes, special processing or other activity, the submittal will be returned, marked “Action Not Required”.

C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

D. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

E. Submittals not required by the Contract Documents may not be reviewed and may be

discarded.

F. Architect's Review: Review of shop and setting drawings, roughing drawings, sleeve and opening drawings, product data and samples by Architect will be a general review for conformance with design concept and compliance with information given in contact documents only, and shall not relieve Contractor of responsibility for accuracy of such submissions, nor for proper fitting, construction of work, or for furnishings of materials or work required by the contract and not indicated on submissions. Field dimensions, fabrication details, and job fitting are entirely Contractor's responsibility. Review shall not be construed as approving departures from contract requirements. Any proposed deviations from contract requirements, together with Contractor's explanations thereof, shall be stated in the letter of transmittal. Approval of a specific item shall not indicate approval of an entire assembly of which the item is a component. Should contractor check and certify submissions which indicate changes or deviations from the contract documents, and such changes are found acceptable to Architect, any and all additional costs resulting therefrom, including any cost for changes required to adjacent work or the work of other trades shall be the sole responsibility of Contractor.

RELEASE AGREEMENT – DIGITAL INFORMATION – **SAMPLE**

Architects and sub-consultants have prepared design documents for the project identified as:

These design documents are instruments of the Architect's and sub-consultants' service and they retain all rights to such work. The design documents requested have been issued in hard copy form, which is the basis of a contract with the project Owner.

The undersigned has requested copies of these design documents in digital format.

Architect provides the digital files under the following understandings and conditions:

1. The digital files provided are not the contract documents. The digital files provided may differ from the contract documents and have not been verified against the actual (hard-copy) contract documents.
2. The digital files can deteriorate undetected or be altered without the knowledge of Architect. The use of the digital information is wholly at the risk of the undersigned.
3. Architect is under no obligation to provide any software, hardware, any supplemental files, linked data or operational support required to read and/or manipulate the digital files.
4. Architect is under no obligation to correct, modify, update or to notify the undersigned of the need to correct, modify or update the digital files.
5. The undersigned agrees to indemnify, release and hold Architect and their consultants and the Owner harmless from any responsibility or obligation as to the accuracy or completeness of the digital information and further waives any claim it may have for compensation for additional work, delay costs, losses, consequential damages, and expenses including but not limited to attorney fees resulting from the undersigned relying upon or utilizing the digital information.
6. The digital files are provided for the exclusive use of the undersigned personnel only. The information will not be transferable or transmitted by the undersigned for use by others.
7. The above shall constitute an agreement between Architect and the undersigned for providing a service.
8. This agreement does not constitute a waiver of copyright or transfer of ownership of the said information and documents.

This agreement accepted by: By: _____

Witness: _____ Title: _____

Date: _____

Company: _____

Address: _____

END OF SECTION 013300

SECTION 014000 - QUALITY CONTROL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, general conduct of the Work and Special Requirements, Supplementary Conditions, and other Division 01 Specification Sections, apply to this Section. In the event of any conflicts between the requirements of these Sections, the more stringent requirement shall apply.

1. In Divisions 01 through 48 Sections:

a. The term "Architect" shall be synonymous with the term “Professional”.
b. The terms “Subcontractor”, “Sub-subcontractor”, “Installer”, “Applicator”, “Erector” and similar terms are synonymous with the term “Trade Contractor”.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for quality-control services.

B. Quality-control services include inspections, tests, and related actions, including reports performed by Contractor, by independent agencies, and by governing authorities. They do not include contract enforcement activities performed by Architect.

C. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with Contract Document requirements.

D. Requirements of this Section relate to fabrication and installation procedures.

1. Specific quality-control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified inspections, tests, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with Contract Document requirements.
3. Requirements for Contractor to provide quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

E. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 01 Section "Coordination".
2. Division 01 Section "Testing and Inspections".
3. Division 01 Section "Testing Laboratory Services".
4. Testing by the Contractor of installed materials and equipment is specified in the Technical Sections (Divisions 02 through 48) of these Specifications.

F. Testing requirements for real property installed equipment (RPIE) to be furnished by the contractor when such testing is required by code, contract or the manufacturer shall be performed in a pre-approved testing laboratory or in the absence of such by the manufacturer or its authorized representative at its place of business. The contractor shall

provide a five (5) days' notice to the University and Architect/Engineer through the Owner's Project Manager. The University and the Architect/Engineer shall have the right to witness all tests.

G. The contractor will hire and pay for a qualified testing agency.

1.3 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and ensure that proposed construction complies with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that completed construction complies with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full-size, physical example assemblies to illustrate finishes and materials. Mockups are used to verify selections made under Sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Mockups establish the standard by which the Work will be judged.

D. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

1.4 RESPONSIBILITIES

A. **Contractor Responsibilities: Unless otherwise indicated as the responsibility of another identified entity, Contractor shall provide inspections, tests, and other quality-control services specified elsewhere in the Contract Documents and/or required by authorities having jurisdiction. Costs for these services are included in the Contract Sum.**

1. Where individual Sections specifically indicate that certain inspections, tests, and other quality-control services are to be done these services will be the Contractor's responsibility. The Contractor shall employ and pay a qualified independent testing agency to perform quality-control services. Costs for these services are included in the Contract Sum.

B. Retesting: The Contractor is responsible for retesting where results of inspections, tests, or other quality-control services prove unsatisfactory and indicate noncompliance with Contract Document requirements, regardless of whether the original test was Contractor's responsibility.

1. The cost of retesting construction, revised or replaced by the Contractor, is the Contractor's responsibility where required tests performed on original construction indicated noncompliance with Contract Document requirements. The contractor shall pay for all costs including administrative cost incurred by the University.
2. When the University and/or Architect/Engineer require special or additional inspections, testing or approvals due to Contractor's failure to comply with contract specifications, industry standards, good building practices, any applicable code procedures including but not limited to ASIC, ASTM, etc., whether or not testing is required by the contract documents for any individual component, entire system or process, the Contractor will secure the service of such special or additional

inspections, testing or approvals. In the event such special or additional inspections and testing reveal a failure of the work to comply with the terms and conditions of the contract, the contractor shall also bear all costs necessary to repair or replace the work as required by the Architect/Engineer.

C. Associated Services: Cooperate with agencies performing required inspections, tests, and similar services, and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include, but are not limited to, the following:

1. Provide access to the Work.
2. Furnish incidental labor and facilities necessary to facilitate inspections and tests.
3. Take adequate quantities of representative samples of materials that require testing or assist the agency in taking samples.
4. Provide facilities for storage and curing of test samples.
5. Deliver samples to testing laboratories.
6. Provide the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.
7. Provide security and protection of samples and test equipment at the Project Site.

D. Duties of the Testing Agency: The independent agency engaged to perform inspections, sampling, and testing of materials and construction specified in individual Sections shall cooperate with the Architect, the Contractor and the Owner in performance of the agency's duties. The testing agency shall provide qualified personnel to perform required inspections and tests.

1. The agency shall notify the Architect, the Contractor, and the Owner promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. The agency is not authorized to release, revoke, alter, or enlarge requirements of the Contract Documents or approve or accept any portion of the Work.
3. The agency shall not perform any duties of the Contractor.

E. Coordination: Coordinate the sequence of activities to accommodate required services with a minimum of delay. Coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.

1. The Contractor is responsible for scheduling times for inspections, tests, taking samples, and similar activities.

1.5 SUBMITTALS

A. Submit a certified written report of each inspection, test, or similar service.

1. Distribute copies of each report to Owner, Architect and Engineer. Distribution of reports shall be made promptly, upon the completion of each test or inspection. **A field report will be distributed to the Owner's Project Manager prior to the Inspector leaving the jobsite on any day during which a test or inspection has been done. A final inspection report will be required from the inspection agency to all parties within five (5) business days following the inspection. Test reports will be required within (5) business days following the actual test date.**
2. Submit additional copies of each written report directly to the governing authority, when the authority so directs.
3. Report Data: Refer to specification sections of Divisions 02 through 48 for submittal requirements applicable to inspection and test reports. In general, each report shall include:

a. Date of issue.
b. Project title and number.
c. Name, address, and telephone number of testing agency.
d. Dates and locations of samples and tests or inspections.
e. Names of individuals making the inspection or test.
f. Designation of the Work and test method.
g. Identification of product and Specification Section.
h. Complete inspection or test data.
i. Test results and an interpretation of test results.
j. Ambient conditions at the time of sample taking and testing.
k. Comments or professional opinion on whether inspected or tested Work complies with Contract Document requirements.
l. Name and signature of laboratory inspector.
m. Recommendations on retesting.

4. All submittals of inspections and test reports or requests for approval shall be accompanied by a certification signed by the contractor attesting to his/her knowledge of the submittal, acceptance of its findings and acknowledgement that material tested meets the required standards and certify the report's representation of the facts. Failure to provide the written certification shall be grounds for rejection of the submittal.

1.6 QUALITY ASSURANCE

A. Qualifications for Service Agencies: Engage inspection and testing service agencies, including independent testing laboratories, that are prequalified as complying with the American Council of Independent Laboratories' "Recommended Requirements for Independent Laboratory Qualification" and that specialize in the types of inspections and tests to be performed.

1. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the state where the Project is located.
2. Each independent inspection and testing agency engaged on the Project shall be pre-qualified by the Division of Building and Construction of the State of New Jersey to perform the types of tests and inspections required.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 REPAIRS AND PROTECTION

A. General: Upon completion of inspection, testing, sample taking and similar services, repair damaged construction and restore substrates and finishes.

1. Comply with Contract Document requirements for Division 01 Section "Cutting and Patching."
2. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
3. Restore patched areas and extended restoration into adjoining areas in a manner that eliminates evidence of patching.

B. Protect construction exposed by or for quality control service activities, and protect repaired construction.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing, or similar services.

END OF SECTION 014000

SECTION 014100 - TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 RELEATED DOCUMENTS

A. Drawings and general provisions of the contract, including general conditions, general conduct of the work and special requirements, supplementary conditions, and other Division 01 specification sections, apply to this section. In the event of any conflicts between the requirements of these sections, the more stringent requirement shall apply.

1.2 SECTION INCLUDES

A. Selection and payment.

B. Contractor submittals.

C. Laboratory responsibilities.

D. Laboratory reports.

E. Limits on testing laboratory authority.

F. Contractor responsibilities.

1.3 RELATED SECTIONS

A. General Conditions: Inspections, testing, and approvals required by public authorities.

B. Individual Specification Sections: Inspections and tests required, and standards for testing.

C. Drawings and general provisions of the Contract, including General Conditions, General Conduct of the Work and Special Requirements, Supplementary Conditions, and other Division 01 Specification Sections, apply to this Section. In the event of any conflicts between the requirements of these sections, the more stringent requirement shall apply.

1.4 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM): ASTM C802 - Practice for Conducting an Interlaboratory Test Program to Determine the Precision of Test Methods for Construction.

B. ASTM C1077 - Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.

C. ASTM D290 - Recommended Practice for Bituminous Mixing Plant Inspection.

D. ASTM D3740 - Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

E. ASTM D4561 - Practice for Quality Control Systems or an Inspection and Testing Agency for Bituminous Paving Materials.

F. ASTM E329 - Practice for Use in the Evaluation of Inspection and Testing Agencies as Used in Construction.

G. ASTM E548 - Practice for Preparation of Criteria for Use in the Evaluation of Testing Laboratories and Inspection Bodies.

H. Testing, Quality Assurance, and Evaluating Building Components in Accordance with Test Methods Promulgated by ASTM Committee E6.

1.5 SELECTION AND PAYMENT

A. Contractor shall employ and pay for services of an independent Testing Laboratory, and Balancing Laboratory/Organization, approved by Owner and Architect/Engineer, to perform all specified inspecting and testing.

B. Employment of testing laboratory in NO WAY relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

1.6 QUALITY ASSURANCE

A. Comply with requirements of ASTM C802, ASTM C1077, ASTM D290, ASTM D3740, ASTM D4561, ASTM E329, ASTM E548, and ASTM E699.

B. Testing Laboratory Qualifications: Shall have been inspected by a nationally recognized inspection agency, acceptable to Owner and Architect/Engineer. Evidence of such inspection and current status shall be provided to Owner and Architect/Engineer. In addition, the approved lab shall document participation in a nationally recognized soils and concrete reference testing program during the twelve (12) months preceding the start of work on this project. Results of reference testing shall indicate an acceptable rating for the laboratory to be considered by the Owner and Architect/Engineer.

C. Laboratory: Authorized to operate in the State in which Project is located.

D. Laboratory Staff: Maintain a full time registered Professional Engineer on staff to review services.

E. Testing Equipment: Shall be calibrated at reasonable intervals with devices of accuracy traceable to either National Bureau of Standards or accepted values of natural physical constants.

1.7 CONTRACTOR SUBMITTALS

A. PRIOR TO START OF WORK, submit testing laboratory name, address, and telephone number, and names of full time registered Engineer and responsible officer.

B. Submit copy of report of laboratory facilities inspection made by Materials Reference Laboratory of National Bureau of Standards during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.

1.8 LABORATORY RESPONSIBILITIES

A. Test samples of required items submitted by Contractor.

B. Provide qualified personnel at site. Cooperate with Architect/Engineer and Contractor in performance of services.

C. Perform specified inspecting, sampling, and testing of Products in accordance with specified standards.

D. Ascertain compliance of materials and mixes with requirements of Contract Documents.

E. Promptly notify Architect/Engineer and Contractor of observed irregularities or non-conformance of Work or Products.

F. Perform additional inspection and tests required by Architect/Engineer.

1.9 LABORATORY REPORTS

A. After each inspection and test within five (5) business days, promptly submit three (3) copies of laboratory report to Owner, Architect/ Engineer, and to Contractor. Include:

1. Date issued
2. Project title and number
3. Name of inspector
4. Date and time of sampling or inspection
5. Identification of product and specifications section
6. Location in the Project
7. Type of inspection or test
8. Date of test
9. Results of tests
10. Conformance with Contract Documents.

B. When requested by Architect/Engineer, provide interpretation of test results.

1.10 LIMITS ON TESTING LABORATORY AUTHORITY

A. Laboratory MAY NOT release, revoke, alter, or enlarge on requirements of Contract Documents.

B. Laboratory MAY NOT approve or accept any portion of the Work.

C. Laboratory MAY NOT assume any duties of Contractor.

D. Laboratory HAS NO authority to stop the Work.

1.11 CONTRACTOR RESPONSIBILITIES

A. Deliver to laboratory at designated location, adequate samples of materials proposed to be used, which require testing.

B. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.

C. Provide incidental labor and facilities:

1. to provide access to Work to be tested,
2. to obtain and handle samples at the site or at source of Products to be tested,
3. to facilitate tests and inspections,
4. to provide storage and curing of test samples.

D. Notify Architect/Engineer, Owner and laboratory 24 hours prior to expected time for operations requiring inspecting and testing services.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 014100

SECTION 014523 – TESTING AND INSPECTIONS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the testing and inspection requirements as specified herein.

1.3 RELATED SECTIONS

A. Requirements for testing and inspection shall be described in various Sections of these Specifications. Where no testing and inspection requirements are described but the Owner determines that it is necessary, the Owner may request additional testing and inspection to be performed at his own expense.

B. Work Not Included

1. Unless otherwise noted in this Section or other Section of work, the Owner will select a pre-qualified independent testing laboratory and inspection professional.
2. Unless otherwise noted in this Section or other Sections of work, the Owner will pay for all initial services of the testing laboratory and inspection professionals as further described in Article 2.1 of this Section of these Specifications.

1.4 QUALITY ASSURANCE

A. The testing laboratory will be qualified to the Owner's approval in accordance with ASTM E 329-14a "Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection."

B. Testing, when required, will be in accordance with all pertinent codes and regulations and with selected standards of the American Society for Testing and Materials.

1.5 PRODUCT HANDLING

A. Promptly process and distribute all required copies of test reports and related instructions to ensure all necessary retesting and/or replacement of materials with the least possible delay in progress of the work.

PART 2 - PRODUCTS

2.1 PAYMENTS FOR TESTING AND INSPECTION SERVICES

A. Initial Services: The Owner will pay for all initial testing and inspection services.

B. Retesting: When initial tests and inspections indicate non-compliance with local Codes and the Contract Documents, all subsequent retesting occasioned by the non- compliance shall be performed by the same testing laboratory and inspectors and the costs thereof will be deducted by the Owner from the Contract Sum.

2.2 CODE COMPLIANCE TESTING AND INSPECTION

A. Inspections and tests required by Codes or Ordinances, or by a plan approval authority, shall be paid by for by the Owner unless otherwise noted in this Section or other Sections of work. Retesting or inspection as required shall conform to the requirements of Article 2.1 B of this Section.

2.3 CONTRACTOR'S TESTING

A. Inspection or testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.

B. Where operating tests are specified, the Contractor shall test his work as it progresses, on his own account, and shall make satisfactory preliminary tests in all cases before applying for official tests.

C. Tests shall be made in the manner specified, for the different branches of the work. Each test shall be made on the entire system for which such test is required, wherever practical. In case it is necessary to test portions of the work independently, the Contractor shall do so without extra compensation. The Contractor shall furnish all labor, material and apparatus, make corrections and conduct the official test. The test will be conducted in the presence of a representative of the Architect.

D. All parts of the mechanical and electrical work and associated equipment shall be tested and adjusted to work properly and be left in perfect operating condition. All defects disclosed by these tests shall be corrected to the satisfaction of the Architect and Engineer without any additional cost to the Owner. Tests shall be repeated on this repaired or replaced work if deemed necessary by the Architect. The Architect shall be notified at least forty-eight (48) hours in advance of all tests, and shall be represented at tests that he deems necessary. The Contractor shall furnish all necessary instruments, other equipment, and personnel required for such tests.

E. Required certificates of inspection, testing or approval shall be secured by the Contractor and promptly delivered by him to the Architect.

F. If the Architect or Engineer is to observe the inspections, tests or approvals required by the Contract Documents, he will endeavor to do so promptly and, where practicable, at the source of supply.

PART 3 - EXECUTION

3.1 COOPERATION WITH TESTING LABORATORY AND INSPECTORS

A. Representatives of the testing laboratory and inspectors shall have access to the work at all times. Provide facilities for such access in order that they may properly perform their functions.

3.2 SCHEDULES

A. Establishing Schedule: By advance discussions with the inspection service and testing laboratory selected by the Owner, determine the time required to perform inspections and tests and to issue each of its findings. Provide all required time within the construction schedule.

B. Revising Schedule: When changes of construction schedule are necessary during construction, coordinate all such changes of schedule with the inspectors and testing laboratory as required.

C. Adherence to Schedule: When the testing laboratory is ready to test according to the determined schedule but is prevented from testing or taking specimens due to incompleteness of the work, all extra costs for testing attributable to the delay will be back-charged to the Contractor.

3.3 TAKING SPECIMENS

A. All specimens and samples for testing, unless otherwise provided in these Contract Documents, will be taken by the testing laboratory; all sampling equipment and personnel will be provided by the testing laboratory; and all deliveries of specimens and samples to the testing laboratory will be performed by the testing laboratory.

END OF SECTION 014523

SECTION 014200- REFERENCE STANDARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, General Conduct of the Work and Special Requirements, Supplementary Conditions, and other Division 01 Specification Sections, apply to this Section. In the event of any conflicts between the requirements of these Sections, the more stringent requirement shall apply. In the event of any conflicts between the requirements of these Sections, the more stringent requirement shall apply.

1.2 DEFINITIONS

A. General: Basic contract definitions are included in the Conditions of the Contract.

B. "Indicated": The term "indicated" refers to graphic representations, notes, or schedules on the Drawings; or to other paragraphs or schedules in the Specifications and similar requirements in the Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help the user locate the reference. Location is not limited.

C. “Directed": Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean directed by the Architect, requested by the Architect, and similar phrases, unless any item associated with these terms will result in a monetary change order to the project. If the items associated with these terms require a change order the Owner must be notified prior to any action being taken.

D. "Approved": The term "approved," when used in conjunction with the Architect's action on the Contractor's submittals, applications, and requests, and the Architect's and Owners duties and responsibilities are limited as specified by the Conditions of the Contract.

E. "Regulations": The term "regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conversations and agreements within the construction industry that control performance of the Work.

F. "Furnish": The term "furnish" means to supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": The term "install" describes operations at the Project site including the actual unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": The term "provide" means to furnish and install, complete and ready for the intended use.

I. "Installer": An installer is the Contractor or another entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier, to perform a particular construction activity, including installation, erection, application, or similar operations. Installers are required to be experienced in the operations they are engaged to perform.

1. The term "experienced," when used with the term "installer," means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with the special requirements indicated; and having complied with requirements of authorities having jurisdiction.
2. Trades: Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespersons of the corresponding generic name. However, work resulting from any construction activity performed by a "Trade" must meet all quality standards acceptable to the Architect and Owner

J. "Project site" is the space available to the Contractor for performing construction activities, either exclusively or in conjunction with others performing other work as past of the Project. The extent of the Project site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.

K. "Testing Agencies": A testing agency is an independent entity engaged to perform specific inspections or tests, either at the Project site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

L. If Requested: If requested by the Owner.

M. Where: Where or when practicable in the judgment of the Owner.

N. Satisfactory: Acceptable in the judgment of the Owner.

O. As Required: As required by the Architect, or as field conditions dictate.

P. Replace: To remove an existing product or service, and furnish and install an indicated product in its place.

Q. Specifications: The total and complete specifications of this Project as identified by the Architect, and the Architects consultants through the Architect, including referenced standard specifications, the General Specifications and the Technical Specifications as indexed.

R. System/ Assembly: In the context of this Project, where a 'system' or an 'assembly' as indicated in the Specifications and/or Drawings, it shall consist of the sum of all the relevant pasts and/or materials specific to the use of the system or assembly indicated; installed complete, in place, and in working order. All said pasts and/or materials required for a complete system indicated, shall be supplied and installed as past of the Base Bid Price for a complete, proper, and fully functional installation, whether specifically detailed or not. All materials for the system or assembly shall be installed completely, all necessary connections to other construction shall be provided. Upon completion of this system or assembly, the sum of all the parts that constitute the make-up of this unit, shall function and/or operate properly according to its intended design.

S. Mandatory: Means as required by code, any Building Authority, and any and all governing laws. All mandatory requirements for construction shall be included in the Base Bid Price for the Project.

T. Functional: Items(s) installed that are to operate properly or as intended.

U. Typical: A condition, detail, or other item that is common to an identified system, assembly, or any other construction condition where the essential characteristics are the same.

1.3 SPECIFICATION FORMAT AND CONTENT EXPLANATION

A. Specification Format: These Specifications are organized into Divisions and Sections based on the 48-division format and CSI/ICSC's "MasterFormat" numbering system.

B. Specification Content: These Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows.

1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be interpolated, as the sense requires. Singular words shall be interpreted as plural and plural words interpreted as singular where applicable as the context of the Contract Documents indicates.

a. The Technical Specifications are of the abbreviated type and include incomplete sentences. Omissions of words or phrases such as "the Contractor shall"; "in conformance with"; "shall be"; "as noted on the Drawings"; "according to the Plans"; "a" "an"; "the"; and "all" are intentional. Omitted words and phrases shall be supplied by inference in the same manner, as they are when a "note" occurs on the Drawings. Works "shall be" "shall have", and "shall" will be supplied by inference where a colon (:) is used within sentences or phrases.

2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the Section Text, subjective language is used for clarity to describe responsibilities that must be fulfilled indirectly by the Contractor or by others when so noted.

a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
b. Abbreviated references to trade associations, technical societies, recognized authorities and other institutions are included in the contract documents. Any abbreviation or organization not recognized by the Contractors shall be requested from the Architect for interpretation. Failure to request and receive an interpretation shall not relieve the Contractor from performing and/or supplying materials or workmanship in compliance with specified references to the satisfaction of the Architect or Owner

C. References: References to known standard specifications shall mean and intend the latest edition of such specifications adopted and published as of the date of the invitation to bid.

D. Divisions: Divisions of the specifications into sections is done for the convenience of reference and is not intended to control the Contractor in dividing the Work among subcontractors or to limit the scope of work performed by any trade under any section

1.4 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a past of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of the date of the Contract Documents.

C. Conflicting Requirements: Where compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to the Architect for a decision before proceeding.

1. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of the requirements. Refer uncertainties to the Architect for a decision before proceeding

D. Copies of Standards: Each entity engaged in construction on the Project must be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, the Contractor shall obtain copies directly from the publication source and make them available on request.

E. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where abbreviations and acronyms are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards-producing organization, authorities having jurisdiction, or other entity applicable to the context of the text provision. Refer to Gale Research's "Encyclopedia of Associations" or Columbia Books' "National Trade & Professional Associations of the U.S.," which are available in most libraries.

1.5 GOVERNING REGULATIONS AND AUTHORITIES

A. Copies of Regulations: Obtain copies of the following regulations and retain at the Project site to be available for reference by parties who have a reasonable need:

1. Any and all Federal, State or Local regulations required by the Agency having jurisdiction to be retained or posted at the project site

1.6 SUBMITTALS

A. Permits, Licenses, and Certificates: For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.7 DRAWINGS

A. The Contractor shall provide all quantities, items, articles, materials, operations, or methods listed, mentioned, implied, scheduled, or specified, on the Drawings, including all labor, materials, equipment, and incidentals required for their completion.

B. Intent of the Drawings:

1. As with any plan, the Contractor shall be responsible for verifying all field conditions, whether or not noted in the plans prior to construction. Any discrepancies shall be resolved with the Owner prior to construction. The start of construction will not be delayed due to the Contractors need to verify all field conditions. Verification of items must be scheduled by the Contractor so as not to impede the progress of the work. The Contractor shall be responsible for correcting damage resulting from Contractor's failure to verify field conditions. Architect/Engineer and Owner liability for accuracy of survey information.
2. The implied intent of the Drawings, includes the overall layout of the Project, inclusive of site structures, site improvements, location of all items required during construction, the extent of construction and the extent of the materials.
3. All such Drawings and Specifications constitute the Project as a whole, and are as a result, directly related to one another. The Drawings and Specifications are not divided into, or are intended to be divided into separate entities according to building trades or local practice. It is the responsibility of the Contractor to disseminate all information represented on the Drawings and Specifications so that all trades and sub-trades will have complete and thorough knowledge of the Project intent. No requests for Change Orders, time extensions, or other considerations will be accepted if the Contractor fails to properly coordinate information to the various trades/sub-trades.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 014200

SECTION 015000 – CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions, and other Division 01 Specification Sections, apply to this Section. In the event of any conflicts between the requirements of these Sections, the more stringent requirement shall apply.

1.2 SUMMARY

A. This Section includes requirements for construction facilities and temporary controls, including temporary utilities, support facilities, and security and protection. Temporary utilities include, but are not limited to, the following:

1. Temporary water service and distribution.
2. Temporary electric power and light.
3. Temporary heat.
4. Telephone service.
5. Sanitary facilities, including drinking water.
6. Storm and sanitary sewer.

B. Support facilities include, but are not limited to, the following:

1. Field offices and storage sheds.
2. Temporary roads, paving and truck wash-down station.
3. Dewatering facilities and drains.
4. Temporary enclosures.
5. Hoists.
6. Temporary project identification signs and bulletin boards.
7. Waste disposal services.
8. Rodent and pest control.
9. Construction aids and miscellaneous services and facilities.

C. Security and protection facilities include, but are not limited to, the following:

1. Temporary fire protection.
2. Barricades, warning signs, and lights.
3. Sidewalk bridge or enclosure fence for the site.
4. Environmental protection.

D. The Contractor is responsible for all costs associated with the supply, maintenance or usage of temporary utilities and construction related facilities unless indicated otherwise in this Section.

1.3 QUALITY ASSURANCE

A. Regulations: Comply with industry standards and applicable laws and regulations of

authorities having jurisdiction including, but not limited to, the following:

1. Building code requirements.
2. Health and safety regulations.
3. Utility company regulations.
4. Police, fire department, and rescue squad rules.
5. Environmental protection regulations.

B. Standards: Comply with NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations," ANSI A10 Series standards for "Safety Requirements for Construction and Demolition," and NECA Electrical Design Library "Temporary Electrical Facilities."

1. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70 "National Electric Code."

C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.4 PROJECT CONDITIONS

A. Temporary Utilities: Prepare a schedule indicating dates for implementation and termination of each temporary utility.

B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the Work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist on-site.

C. Provide waste removal services as required to maintain the site in a clean and orderly condition.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide new materials. If acceptable to the Owner, the Contractor may use undam- aged, previously used materials in serviceable condition. Provide materials suitable for use in- tended.

B. Paint: Comply with requirements.

1. For job-built temporary offices, shops, sheds, fences, and other exposed lumber and ply- wood, provide exterior-grade acrylic-latex emulsion over exterior primer.
2. For sign panels and applying graphics, provide exterior-grade alkyd gloss enamel over exterior primer.

C. Tarpaulins: Provide waterproof, fire-resistant, UL-labeled tarpaulins with flame-spread rating of 15 or less. For temporary enclosures, provide translucent, nylon-reinforced, laminated polyethylene or polyvinyl chloride, fire-retardant tarpaulins.

D. Water: Provide potable water approved by local health authorities.

2.2 EQUIPMENT

A. General: Provide new equipment. If acceptable to the Owner, the Contractor may use undam- aged, previously used equipment in serviceable condition. Provide equipment suitable for use intended.

B. Water Hoses: Provide 3/4-inch, heavy-duty, abrasion-resistant, flexible rubber hoses 100 feet long, with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shutoff nozzles at hose discharge.

C. Electrical Outlets: Provide properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-Volt plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button, and pilot light for connection of power tools and equipment.

D. Electrical Power Cords: Provide grounded extension cords. Use hard-service cords where ex- posed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.

E. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered-glass enclosures where exposed to breakage.

F. Fire Extinguishers: Provide hand-carried, portable, UL-rated; Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide hand-carried, portable, UL-rated, Class ABC, dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for the exposures.

1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work and the areas adjacent to the Work area. Relocate and modify facilities as required.

B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Engage the appropriate local utility company to install temporary service or connect to existing service. Where company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with company recommendations.

1. Arrange with company and existing users for a time when service can be interrupted, if necessary, to make connections for temporary services.
2. Provide adequate capacity at each stage of construction. Prior to temporary utility avail- ability, provide trucked-in services.
3. Obtain easements to bring temporary utilities to the site where the Owner's easements cannot be used for that purpose.
4. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner. Neither the Owner will accept cost or use charges as a basis of claims for Change Orders.
5. Install services to cause minimum disruption to area's adjacent to the work area.
6. Add provisions for work not in Contract but served by temporary facilities, if required.

B. Water Service: Contractor may use existing water service in the area of work.

C. Temporary Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnects, automatic ground-fault interrupters, and main distribution switchgear. **Cost of temporary electric power usage is the Contractors responsibility. Cost shall be included in the bid.**

D. Initial temporary service shall be three (3) phase, or single phase. Temporary light and power installations, wiring and miscellaneous electrical hardware must meet the electric code. Electrical characteristics shall be provided to meet all temporary light and power reasonably required as herein and hereinafter specified or as included under the general conditions. The contractor shall pay the cost of running temporary services. **All costs shall be included in the bid.**

1. Power Distribution System: Install wiring overhead and rise vertically where least exposed to damage. Where permitted, wiring circuits not exceeding 125 Volts, ac 20 Ampere rating, and lighting circuits may be nonmetallic-sheathed cable where overhead and exposed for surveillance.

E. Power outlets shall be fed independently of the temporary lighting system. The extension of service shall include the necessary wiring of sufficient capacity to the location of the well for the operation of the well pump in the event a water well is the source of water supply for the project. Where service of a type other than herein mentioned is required, the contractor requiring it shall pay all costs of such special service.

F. Temporary Lighting: Provide temporary lighting with local switching. **Cost of temporary lighting usage is the contractors' responsibility. Cost shall be included in the bid.**

1. The contractor shall provide double sockets at a maximum of thirty feet (30') on centers in large areas. One (1) socket shall contain a 150-watt lamp and the other socket shall be a grounding type to accept a receptacle plug for small, single-phase loads to be used for short periods of time.
2. Install and operate temporary lighting that will fulfill security and protection requirements without operating the entire system. Provide temporary lighting that will provide adequate illumination for construction operations and traffic conditions.

G. The contractor shall observe the requirements of the Federal Occupational Safety and Health Act (OSHA) of 1970 with regard to temporary light and power.

H. Temporary Heat: Provide temporary heat required by construction activities. Select safe equipment that will not have a harmful effect. **Any cost associated with the supply, maintenance and usage of temporary heat will be the responsibility of the contractor. Cost of temporary heat shall be included in the bid.**

I. Use of gasoline-burning space heaters, open flame, or salamander heating units is prohibited.

J. Should electricians be required to supervise and maintain equipment required for the provision of heat, the payment for the services of the supervisors and/or maintenance personnel shall be the responsibility of the Contractor. The contractor shall pay the cost of all fuel consumed in the operation of the generating unit for supplying temporary heat.

K. All heating equipment shall be NFPA approved. Heaters shall be approved by a recognized testing laboratory and must be equipped with a positive shut-off safety valve. Notwithstanding the above, all temporary heating equipment will comply with all Federal and State laws and regulations.

L. Temporary Telephones: Contractor shall utilize their own cell phones for service.

M. The contractor may utilize the Owner's sanitary/wash facilities, drinking water, etc. if these amenities are available. The contractor shall only use these facilities with Owner's permission. The contractor will be responsible to reimburse the Owner for all Owner provided utilities use by the Contractor. Further, should the contractor elect to utilize Owner provided utilities the contractor will be responsible to repair all damage and replace all damaged items before the project will be considered substantially completed. The Owner will not be required to make final payment to the contractor until such damage is repair or replaced to its original or better than original condition.

3.3 SUPPORT FACILITIES INSTALLATION

A. Temporary storage sheds are not permitted on the Owner's property.

B. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities.

1. Where temporary wood or plywood enclosure exceeds 100 sq. ft. in area, use UL-labeled, fire-retardant-treated material for framing and main sheathing.

C. Temporary Lifts and Hoists: Contractor may utilize the existing elevator for bringing materials to the area of work and disposing materials to the area of work provided that:

1. The Contractor provides temporary protection materials, padding, etc. for the elevator cab.
2. The Contractor observes the weight capacity of the existing elevator cab.
3. The Contractor is only permitted to use the existing elevator from the hours of 9:00 p.m. to 6:00 a.m. Monday through Friday.
4. The Contractor notify the Owner of the elevator use three (3) business days prior to use.

D. Project Identification and Temporary Signs: Prepare project identification and other signs of size indicated. Install signs where indicated to inform the public and persons seeking

entrance to the Project. Support on posts or framing of preservative-treated wood or steel. Do not permit installation of unauthorized signs.

1. Temporary Signs: Prepare signs to provide directional information to construction personnel and visitors.

E. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than 7 days during normal weather or 3 days when the temperature is expected to rise above 80 deg F. Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material lawfully.

1. Provide containers with lids. Dispose of waste off-site periodically.

F. Individual Project circumstances may require use of other construction aids and miscellaneous facilities, such as walkways, scaffoldings, platforms, swing stages, ramps and bridges, incidental sheeting and shoring, demolition waste chutes, and similar construction aids. Add requirements as necessary to suit Project.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers" and NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations."

1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor at or near each usable stair- well.
2. Store combustible materials in containers in fire-safe locations.
3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for fighting fires. Prohibit smoking in hazardous fire-exposure areas.
4. Provide supervision of welding operations, combustion-type temporary heating units, and similar sources of fire ignition.

B. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed, provide lighting, including flashing red or amber lights.

C. Security Enclosure and Lockup: Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

1. Storage: Where materials and equipment must be stored, and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.

D. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways, and subsoil might be contaminated or polluted or that other undesirable effects might result. Avoid use of tools and equipment that produce

harmful noise. Re- strict use of noise-making tools and equipment to hours that will minimize complaints from per- sons or firms near the site.

1. No burning will be permitted on the site.
2. It will be the Contractor's responsibility to control dust by a means acceptable to the Owner. The Contractor shall make due allowance in his bid to cover these non-productive costs.

E. Protection of Utilities:

1. The Contractor shall exercise special care when working near existing utility installations such as lights, ducts, structures, underground trench laid cables, cable markers, pads, water lines, underground oil lines, railroads and other installations, to ensure that no damage is done to them and that the underground wiring to such utilities is not damaged or rooted out, or pipelines broken or punctured.
2. If the Contractor damages any installation, the Contractor shall repair at no cost to the Owner the damaged item to the Owner's satisfaction. At the Owners discretion, repairs will be done continuously on a 24-hour per day basis until completed. The Contractor shall submit for approval the name of an electrical contractor and a plumbing contractor who shall be available on a 24 hour a day basis to affect any repairs as may be necessary due to Contractor error.
3. The Contractor shall obtain (if available) as-built site underground information prior to beginning excavation to minimize the possibility of interruption or damage to existing facilities. The lack of this information shall not excuse damage to the utilities by the con- tractor or the requirement to make necessary repairs immediately, the Contractor shall pay for Cost of the repair work.

F. Protection and Restoration of Property and Landscape: The Contractor shall be responsible for the preservation of all public and private property. All land monuments and property markers shall be preserved until the Owner has witnessed and recorded their location.

G. Protection of Existing Trees, Shrubs, and Vegetation to Remain: Contractor shall take all means necessary to protect existing trees, shrubs, and vegetation. Contractor and its forces shall abide by the boundaries set by the Drawings for the protection of root systems of all designated trees, shrubs and vegetation. Protection shall be completely in place prior to the start of construction work in any area. Contractor shall clearly mark all restricted areas as indicated on the Drawings and prevent the use of the area by all personnel and equipment until final cleanup.

H. Project Security:

1. The Contractor shall be responsible for monitoring all personnel requiring access to the work site including his personnel, subcontractor's personnel, other contractors working in the same construction area, material delivery trucks, authorized visitors to the site, etc.
2. The Contractor shall be held responsible for the security and protection of its own, sub- contractors and sub-subcontractors equipment, vehicles, trailers, tools, materials, and all other items necessary for the work under this Contract.
3. The Contractor shall be held responsible for the admission of any unauthorized personnel into his work area.
4. In general, provide security and facilities to protect Work, existing facilities, and the Owner's operations from unauthorized entry, vandalism or theft.

3.5 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.

B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.

1. Protection: Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

C. Termination and Removal: Unless the Owner requests that it be maintained longer, remove each temporary facility when the need has ended or no later than Substantial Completion. Complete or, if necessary, restore existing permanent construction that may have been damaged as a result of the use, maintenance or operation of temporary facility for this project. Repair damaged new work, repair or replace, as directed by the Owner, existing work and or conditions, clean ex- posed surfaces, and replace construction that cannot be satisfactorily repaired as a result of the use, maintenance or operation of temporary facilities for the project.

1. Where the area is intended for future landscape development, remove any material, equipment, debris, trash, soil and aggregate fill used as part or in conjunction with the project that do not comply with requirements for fill or subsoil in the area. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks damaged during and as a result of work conducted as part of this project. Replace and/or repair as required and direct by the governing authority and the Owner.

END OF SECTION 015000

SECTION 016000 – PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete product requirements as specified herein, including, but not limited to, the following:

1. Product delivery, storage and handling.

2. Storage and protection.

3. Identifying markings.

4. Temporary use of equipment.

5. General standards.

1.3 RELATED SECTIONS

A. Substitution Procedures - Section 012500.

B. Execution Requirements - Section 017300.

1.4 TRANSPORTATION AND HANDLING

A. Materials, products, and equipment shall be properly containerized, packaged, boxed, and protected to prevent damage during transportation and handling.

B. More detailed requirements for transportation and handling are specified under the technical Sections.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items

that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.

3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.
7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.6 IDENTIFYING MARKINGS

A. Name plates and other identifying markings shall not be affixed on exposed surfaces of manufactured items installed in finished spaces.

1.7 PRODUCT APPROVAL STANDARDS

A. Where the words "or approved equal" or other synonymous terms are used, it is expressly understood that they shall mean that the approval of any such submission is vested in the Architect, whose decision shall be final and binding upon all concerned. All submissions are subject to such approval and shall conform to the requirements of Article 1.8 herein.

1.8 TEMPORARY USE OF EQUIPMENT

A. No equipment intended for permanent installation shall be operated for temporary purposes without the written permission of the Architect.

B. The temporary or trial usage by the Owner of any mechanical device, machinery, apparatus, equipment or any work or materials supplied under this Contract before final completion and written acceptance by the Architect, shall not be construed as evidence of the acceptance of same by the Owner. The Owner shall have the privilege of such temporary and trial usage, for such reasonable length of time as and when the Architect shall deem to be proper for making a complete and thorough test of same and no claim for damage shall be made by the Contractor for the injury to or breaking of parts of such work which may be caused by weakness or inaccuracy of structural parts or by defective material or workmanship. If the Contractor so elects, he may at his own expense, place a competent person or persons to make such trial usage; such trial usage shall be under the supervision of the Contractor.

1.9 GENERAL REQUIREMENTS

A. In the event that it is necessary for the Contractor to store any materials offsite, he shall first obtain the approval of the Architect. The Contractor shall be responsible for insurance and warehousing charges of any materials stored offsite. The Contractor shall also be responsible for the cost of delivery to the job site of any materials that have been stored offsite.

B. Materials delivered to the job site shall be carefully stored and protected from damage. Damaged material shall not be used in the work. The Contractor shall provide, where directed temporary storage facilities as may be required for the storage of all materials which might be damaged by weather.

C. Manufactured articles, materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned as directed by the representative manufacturers, unless otherwise specified.

D. Equipment, plant, and appliances, such as hoists, centering, concrete lifts, construction elevators, cranes, rigging, towers, derricks, walks, ramps, chutes, scaffolding, implements, transportation, cartage and other things necessary and required for the adequate execution of the work and as required by law and applicable Union rules shall be provided and shall be maintained in good and safe mechanical working order, be responsible for their safe use, and remove them when no longer required. Applicable requirements of OSHA shall become and form a part of this document.

E. During handling and installation of work at project site clean and protect work in progress and adjoining work on a basis of perpetual maintenance. Apply suitable protective covering on newly installed work where reasonably required to ensure freedom from damage or deterioration at time of substantial completion; otherwise, clean and perform maintenance on newly installed work as frequently as necessary through remainder of construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

F. To extent possible through reasonable control and protection methods, supervise performance of work in a manner and by means which will ensure that none of the work whether completed or in progress, will be subjected to harmful, dangerous, damaging, or otherwise deleterious exposures during construction period. Such exposures include (where applicable, but not by way of limitation) static loading, dynamic loading, internal pressures, external pressures, high or low temperatures, thermal shock, high or low humidity, air contamination or pollution, water, ice, solvents, chemicals, light, radiation, puncture, abrasion, heavy traffic, soiling, bacteria, insect infestation, combustion, electrical current, high speed operation, improper lubrication, unusual wear, misuse, incompatible interface, destructive testing, misalignment, excessive weathering, unprotected storage, improper shipping/handling, theft and vandalism.

G. Require installer of each major unit of work to inspect substrate to receive the work, and conditions under which the work will be performed, and to report (in writing to Contractor) unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

H. Where installations include manufactured products, comply with manufacturer's applicable instructions and recommendations for installation to whatever extent these are more explicit or more stringent than applicable requirements indicated in the Contract Documents.

I. Inspect each item of materials or equipment immediately prior to installation and reject damaged and defective items.

J. Provide attachment and connection devices and methods for securing work properly as it is installed; true to line and level, and within recognized industry tolerance if not otherwise indicated. Allow for expansions and building movements. Provide uniform joint widths in exposed work, organized for best possible visual effect. Refer questionable visual-effect choices to Architect for final decision.

K. Recheck measurements and dimensions of the work as an integral step of starting each installation.

L. Install work during conditions of temperature, humidity, exposure, forecasted weather, and status of project completion which will ensure best possible results for each unit of work in coordination with entire work. Isolate each unit of work from non-compatible work, as required to prevent deterioration.

M. Coordinate enclosure (closing-in) of work with required inspections and tests, so as to avoid necessity of uncovering work for that purpose.

N. Mounting Heights: Except as otherwise indicated, mount individual units of work at industry-recognized standard mounting heights, for applications indicated. In CMU walls mount units at height closest to manufacturer's recommendation so as to minimize cutting of block coursings. Refer questionable mounting height choices to Architect for final decision.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 016000

SECTION 017300 – EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:

1. General installation of products.
2. Progress cleaning.
3. Starting and adjusting.
4. Protection of installed construction.
5. Correction of the Work.

1.3 RELATED SECTIONS

A. Cutting and Patching - Section 017329.

B. Closeout Procedures - Section 017700.

1.4 SUBMITTALS

A. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

a. Description of the Work.
b. List of detrimental conditions, including substrates.
c. List of unacceptable installation tolerances.
d. Recommended corrections.

2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

3.3 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
4. Maintain minimum headroom clearance of 8 feet in spaces without a suspended ceiling.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

F. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.

G. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

H. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.4 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg. F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Cutting and Patching: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

1. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.

H. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

I. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

J. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

K. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.5 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Section 014000, "Quality Requirements."

3.6 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide continuous protection during construction of all finishes, including taped Masontie joints, and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.1 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Section 017329, "Cutting and Patching."

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly.

E. Remove and replace operating components that cannot be repaired.

F. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300

SECTION 017700– CONTRACT CLOSEOUT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section. In the event of any conflicts between the requirements of these Sections, the more stringent requirement shall apply.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Inspection procedures.
2. Project record document submittal.
3. Operation and maintenance manual submittal.
4. Submittal of warranties.
5. Final cleaning.

B. Closeout requirements for specific construction activities are included in the appropriate Drawings.

1.3 SUBSTANTIAL COMPLETION

A. Substantial Completion: The date of Substantial Completion for the Work, or designated portion thereof, is the date certified by the Architect when the construction is sufficiently complete, in accordance with the Contract Documents, so that the Owner may occupy the project, or the designated portions thereof, for the use for which it was intended PRIOR to the Mandatory Completion Date. Substantial Completion shall be accomplished and the full project and all designated portions thereof, read for use and occupancy by the Owner by the completion milestone deadline listed below. It shall be the responsibility of the Contractor to notify the Architect and Owner in not less than seven (7) calendar days prior to the Substantial Completion Milestone deadline for a “substantial completion” inspection. The University shall issue a Certificate of Substantial Completion (AIA Document G704) at the point in time when the inspection has been fully completed and the appropriate approvals and certificates have been granted by governing authorities and obtained by the Contractor.

1. IT IS THE INTENT OF THESE SPECIFICAITONS THAT SUBSTANTIAL COMPLETION IS ACHIEVED NO LATER THAN THE DATES AS OUTLINED IN SECTION 011000 “SUMMARY”**. THE CONTRACTOR MUST INCLUDE ANY AND ALL COSTS INCLUDING ANY OVERTIME NECESSARY TO ATTAIN SUBSTANTIAL COMPLETION BY THE DEADLINE LISTED IN SECTION 011000 BASED UPON BEING AWARDED THE PROJECT BY THE DATE LISTED IN SECTION 011000.**

B. **LIQUIDATED DAMAGES ARE PART OF THIS PROJECT. These will be assessed at the following rates:**

1. $1,000.00 per day beyond substantial completion.

C. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following. List items below that are incomplete in request.

1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete.

    a. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
    b. If 100 percent completion cannot be shown, include a list of incomplete items (a project punch list), the value of incomplete construction, reasons the Work is not complete, and a timeline during which the work must be completed.

2. Advise Owner of pending insurance changeover requirements.
3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents.
4. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs, damage or settlement surveys, property surveys, and similar final record information.
6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
8. Complete startup testing of systems and instruction of the Owner’s operation and maintenance personnel.
9. Disconnect and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
10. When mechanical, electrical or other equipment is installed, it shall be the responsibility of the contractor to maintain, warrant and operate it for such period of time as required by the contract documents or as necessary for the proper inspecting and testing of the equipment for adequately instructing the University's operating personnel. All costs associated with the maintenance, warranty, operations, inspection and testing of equipment in addition to instructing University personnel shall be borne by the contractor. All tests shall be conducted in the presence of and upon timely notice to the contracting officer, Owner’s Project Manager and Architect/Engineer prior to acceptance of the equipment.
11. Owner’s warranties will start at Final Acceptance of the Project.

D. Pre-final Inspection:

1. When the Contractor has completed all work and is satisfied the Project is in compliance with the Contract Documents, it will notify the Owner and Architect, in writing, that the Project is complete and ready for inspection. The Owner and Architect will arrange for and conduct an inspection of the Project by the Owner, Architect, Engineers and the Contractor. The Owner will be provided with a reasonable time to arrange for and conduct an inspection.

2. The Owner and Architect will document any deficiencies on a written punch list and will arrange a meeting with the Contractor to review the punch list, explain deficient items and designate a time frame in which the punch list must be completed. The Contractor will correct all the deficiencies within the designated time frame and notify the Owner in writing, when the Project is ready for re-inspection. The Owner will arrange and conduct the re-inspection of the Project to review the corrected items.
3. The formal list of deficiencies found shall not be considered a final list of all deficient items. Any deficiencies found during instructions to the Owner, inspection for Substantial Completion, beneficial occupancy, or inspection for final acceptance, the Contractor will correct all deficient items per the contract documents prior to final acceptance.

E. Substantial Completion:

1. Upon completion of deficient items and instruction to the Owner, the Contractor will arrange for an inspection of the Project with the Owner and the Architect. This inspection may result in a list of additional items to complete after occupancy, but before final payment and/or may require additional correction prior to occupancy by the Owner.
2. Upon formal notice from the Owner, the Contractor shall then arrange for the submission of all outstanding record documents, including: maintenance manuals, guarantees, warranties, maintenance contracts, and any additional instructions necessary for the operation of the project. The Contractor shall acquaint the Owner with acceptance tests, guarantees, warranties, and maintenance manuals. The Contractor shall also obtain a 'Certificate of Occupancy' or similar releases required to permit the Owner's occupancy of the Project.
3. Should the instruction period find deficiencies, the Owner will notify the Contractor in writing of deficient items.
4. If the inspection confirms that the Project is 'substantially complete' and is 'ready for occupancy', the Owner through the Architect/Engineer will issue a "Certificate of Substantial Completion'. The Certificate will confirm that the Project can be occupied for its intended use. Attached to the Certificate will be any final punch list to be completed. Prior to issuance of the Certificate, the Contractor shall submit a schedule for completion of remaining deficiencies, approved or amended by the Owner.
5. Inspection Procedures: On receipt of a request for inspection, the Architect will either proceed with inspection or advise the Contractor of unfilled requirements. The Architect will prepare the Certificate of Substantial Completion following inspection or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.

    a. The Architect will repeat inspection when requested and assured that the Work is substantially complete.
    b. Results of the completed inspection will form the basis of requirements for final acceptance.

1.4 BENEFICIAL OCCUPANCY

A. Upon issuance of the 'Certificate of Substantial Completion', the Owner may then occupy the Project (or the designated area of the Project).

1.5 FINAL ACCEPTANCE

A. Final Inspection: Upon completion of any remaining deficiencies the Contractor shall notify

the Owner in writing, that the Project is complete and ready for final inspection. The Contractor shall arrange for and conduct the final inspection of the Project with the Owner.

B. Final Acceptance: If the final inspection indicates satisfactory completion of the Work, the Owner through the Architect/Engineer will issue a Change Order adjusting to the final quantities. Following acceptance of the final Change Order, receipt of required affidavits, final release of liens, consent of surety for final payment along with all other documentation required by the contractor documents, the Owner through the Architect will authorize a final Certificate for Payment.

1. Mandatory or Final Completion: Final Completion shall be accomplished and the full project, and all designated portions thereof, completed and ready for use without any further work required within the time frame identified for each phase of work from the date of issuance and as listed on the Certificate of Substantial Completion by the Architect.
2. The guarantee period for all materials, equipment and workmanship shall start on the date of 'Final Acceptance' unless otherwise noted on the Certificate.

C. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.

1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include insurance certificates for products and completed operations where required.
2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
3. Submit a certified copy of the Architect's final inspection list of items to be completed or corrected, endorsed and dated by the Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance and shall be endorsed and dated by the Architect.
4. Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of Substantial Completion or when the Owner took possession of and assumed responsibility for corresponding elements of the Work.
5. Submit consent of surety to final payment.
6. Submit a final liquidated damages settlement statement.
7. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

D. Re-inspection Procedure: The Architect will re-inspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except for items whose completion is delayed under circumstances acceptable to the Owner.

1. Upon completion of re-inspection, the Architect will prepare a certificate of final acceptance. If the Work is incomplete, the Architect will advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
2. If necessary, re-inspection will be repeated.
3. Should the Project require inspections beyond the inspections noted above, i.e. a pre-final and a final inspection only the Owner will reduce from the Contractor's final payment those monies necessary to provide for the cost of the additional inspections. The reduction shall not be considered as a part of any "Liquidated Damages' for failure to complete within the specified Contract Time. The reduction shall not be considered as a penalty to the Contractor; but shall be for the actual cost of monies

required for the reimbursement of fees for the Architect, Engineers, Owner and any other specialists necessary for obtaining final approval of the Work.

1.6 EXCESSIVE DEFICIENCIES

A. During any inspection for Project completion, if it is determined by the Owner, that the Contractor has not sufficiently completed the Work in compliance with the Contract Documents, the Owner may declare that the Project is not sufficiently complete to continue the inspection of the Work. Within three (3) working days of this declaration, the Owner will issue in writing, a list of excessive deficiencies found. Upon receipt of the Owners notice of excessive deficiencies the Contractor will have ten (10) working days to remove such deficiencies. If such deficiencies have not been corrected in the time frame herein specified the Owner can at its' option complete the Work. Any costs incurred by the Owner as a result of its' assuming the responsibilities of the Contractor in this regard will be deducted from any monies remaining to be paid to the Contractor. Should the costs associated with the Owner having to assume responsibility for the work to correct excessive deficiencies exceed the amount of funds remaining to be paid the Contractor shall be liable to the Owner for the difference.

1.7 RECORD DOCUMENT SUBMITTALS

A. General: Do not use record documents for construction purposes. Protect record documents from deterioration and loss in a secure, fire-resistant location. Provide access to record documents for the Architect's reference during normal working hours.

1. **All of the record documentation listed herein shall be provided by the Contractor in hard copy and digitally. Digital copies shall be provided by the Contractor in PDF format, and issued to the Owner via CD. Hard copy shall be provided by the Contractor in an 8-1/2" x 11" binder.**

B. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies from the Work as originally shown. Mark which drawing is most capable of showing conditions fully and accurately. Where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.

1. Mark record sets with red erasable pencil. Use other colors to distinguish between variations in separate categories of the Work.
2. Mark new information that is important to the Owner but was not shown on Contract Drawings or Shop Drawings.
3. Note related change-order numbers where applicable.
4. Organize record drawing sheets into manageable sets. Bind sets with durable-paper cover sheets; print suitable titles, dates, and other identification on the cover of each set.

C. Record Specifications: Maintain one complete copy of the Project Manual, including addenda. Include with the Project Manual one copy of other written construction documents, such as Change Orders and modifications issued in printed form during construction.

1. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications.
2. Give particular attention to substitutions and selection of options and information on concealed construction that cannot otherwise be readily discerned later by direct observation.
3. Note related record drawing information and Product Data.

4. Upon completion of the Work, submit record Specifications to the Architect for the Owner's records.

D. Record Product Data: Maintain one copy of each Product Data submittal. Note related Change Orders and markup of record drawings and Specifications.

1. Mark these documents to show significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the site and from the manufacturer's installation instructions and recommendations.
2. Give particular attention to concealed products and portions of the Work that cannot otherwise be readily discerned later by direct observation.
3. Upon completion of markup, submit complete set of record Product Data to the Architect for the Owner's records.

E. Record Sample Submitted: Immediately prior to Substantial Completion, the Contractor shall meet with the Architect and the Owner's personnel at the Project Site to determine which Samples are to be transmitted to the Owner for record purposes. Comply with the Owner's instructions regarding delivery to the Owner's Sample storage area.

F. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record keeping and submittals in connection with actual performance of the Work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order. Identify miscellaneous records properly and bind or file, ready for continued use and reference. Submit to the Architect for the Owner's records.

G. Maintenance Manuals: Organize operation and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual, heavy-duty, 2-inch (51-mm), 3-ring, vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Include the following types of information:

1. Emergency instructions.
2. Spare parts list.
3. Copies of warranties.
4. Wiring diagrams.
5. Recommended "turn-around" cycles.
6. Inspection procedures.
7. Shop Drawings and Product Data.
8. Fixture lamping schedule.

H. Roughing Drawings and Operating Manuals: Plumbing, HVAC, electrical and other machinery and mechanical equipment items requiring utility service connections shall have their respective shop drawings accompanied by manufacturer's certified roughing drawings indicating accurate locations and sizes of all service utility connections.

I. Sleeve and Opening Drawings: Prior to installing service utilities or other piping, etc. through structural elements of the building, the contractor shall prepare and submit accurate dimensioned drawings to the Construction Manager for approval of the Architect and/or Structural Engineer for approval indicating the positions and sizes of all sleeves and openings required to accommodate his/her work and installation of his/her piping, equipment, etc. and all with reference to the established dimensional grid of the building. Such drawings must be submitted in sufficient time to allow proper coordination with

reinforcing steel shop drawings and proper placing in the field.

J. Control Valve and Circuit Location Charts and Diagrams: The contractor shall prepare a complete set of inked or typewritten control valve and circuit location diagrams, charts, diagrams and lists under frame glass in appropriate designed equipment rooms as directed. The contractor shall also furnish one-line diagrams as well as such color-coding of piping and wiring and identifying charges as specified or required. This information is to be framed under glass and installed where directed. The Contractor shall also provide the University a second complete set of the control valve and circuit location diagrams, charts, diagrams and lists not under glass.

K. Warranties:
1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within the (10) days after completion of the applicable item of work. Leave the date of beginning of time of warranty until the Date of Final Acceptance of the building and prior to receipt of final payment.
2. Make other submittals within ten (10) days after Date of Substantial Completion, prior to final Application for Payment.
3. For items of Work for which acceptance is delayed beyond the Date of Substantial Completion, submit within (10) days after written acceptance, listing the date of acceptance as the beginning of the warranty period. Final payment will not be approved until the Owner has received all warranties.
4. Warranty periods for all items installed as part of the Work under this Contract will start at 'Final Acceptance' of the entire scope of Work on the Project.
5. Co-execute submittals when required.
6. Warranty Manual: Bind all warranties and bonds in a commercial type 81/2" X 11" three D side ring binder with durable plastic covers.

    a. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of General Contractor and equipment suppliers; and name of responsible company principal.
    b. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of the product or work item.
    c. Transmit two (2) copies of the "Warranties Manual" to the University prior to submission of Final Application for Payment.

7. A certificate of Asbestos shall certify that no asbestos or asbestos-containing products are or have been installed as part of this project.

1.8 CLOSEOUT PROCEDURES

A. Operation and Maintenance Instructions: Arrange for each Installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. Provide instruction by manufacturer's representatives if installers are not experienced in operation and maintenance procedures. Include a detailed review of the following items:

1. Maintenance manuals.
2. Record documents.
3. Spare parts and materials.
4. Tools.
5. Lubricants.

6. Fuels.
7. Identification systems.
8. Control sequences.
9. Hazards.
10. Cleaning.
11. Warranties and bonds.
12. Maintenance agreements and similar continuing commitments.

B. As part of instruction for operating equipment, demonstrate the following procedures:

1. Startup.
2. Shutdown.
3. Emergency operations.
4. Noise and vibration adjustments.
5. Safety procedures.
6. Economy and efficiency adjustments.
7. Effective energy utilization.

C. Allow a minimum of three (3) hours training for all of the Owners personnel who will be involved with the maintenance or operation for each piece of equipment or system that requires any type of maintenance or operation.

D. For equipment, or component parts of equipment put into service during construction and operated by the Owner, submit completed documents within ten (10) days after written acceptance and prior to receipt of final payment.

E. The contractor shall submit the as-built documents to the Owner's Project Manager for review by the Architect/Engineer whether altered or not with a certification as to the accuracy of the information thereon at the time of contract completion and before final payment will be made to the contractor. After acceptance by the Architect/Engineer, the contractor will furnish two (2) sets of all shop and/or erection drawings used for as-built documentation.

1. All as-built drawings as submitted by the contractor shall be labeled "as-built" and dated above the title block. This information shall be checked, edited and certified by the Architect/Engineer who shall then transpose such information from the contractor's as-built drawings to the original tracings and certify that such tracing reflect "as-built" status and deliver said tracings to the University. Where shop drawings have been used by the contractor for as-built documentation the tracing provided shall include cross-reference information, which shall be included in the set of as-built drawings furnished to the University. The Contractor shall be responsible for and shall pay for the cost of erasable transparencies for its as-built drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: The General Conditions require general cleaning during construction. Regular site cleaning is included in Division 01 Section "Construction Facilities and Temporary Controls."

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion.

a. Remove labels that are not permanent labels.
b. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are vision-detracting materials. Replace chipped or broken glass and other damaged transparent materials.

1) removal of putty stains from glass and mirrors; wash and polish inside and outside;

c. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films, and similar foreign substances. Restore reflective surfaces to their original condition. Leave concrete floors broom clean and dust free. Vacuum carpeted surfaces.

1) removal of spots, paint and soil from resilient, glaze and unglazed masonry and ceramic flooring and wall work;

d. Vacuum as required and advisable and wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps to a mark free condition.
e. Clean the site, including landscape development areas, of rubbish, litter, and other foreign substances. Sweep paved areas broom clean; remove stains, spills, mud, stones and other foreign deposits. Rake grounds that are neither paved nor planted to a smooth, even-textured surface.

1) restoration of all landscaping, roadway and walkways to pre-existing condition; damage to trees and plantings shall be repaired in the next planting season and such shall be guaranteed for one (1) year from date of repair and/or replanting;

f. removal of marks, undesirable stains, fingerprints, other soil, dust or dirt from painted, decorated or stained woodwork, plaster or plasterboard, metal acoustic tile and equipment surfaces;
g. removal of temporary floor protections; clean, wash or otherwise treat and/or polish all finished floors as directed;
h. clean exterior and interior metal surfaces, including doors and window frames and hardware, of oil stains, dust, dirt, paint and the like; polish where applicable and leave without fingerprints or blemishes;

i. removal of all pollutants of any kind or nature deposited or remaining upon the site or upon the University's property as a result of the construction work on this project;

C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid the Project of rodents, insects, and other pests.

D. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.

E. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from the site and dispose of lawfully.

1. Where extra materials of value remain after completion of associated Work, they become the Owner's property. Dispose of these materials as directed by the Owner.

END OF SECTION 017700

SECTION 017820 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section. In the event of any conflicts between the requirements of these Sections, the more stringent requirement shall apply.

1.2 SUMMARY

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the operation and maintenance data as specified herein.

B. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Maintenance manuals for the care and maintenance of products, materials, and finishes systems and equipment.

C. Related Sections include the following:

1. Division 01 Section "Summary" for coordinating operation and maintenance manuals covering the Work of multiple contracts.
2. Division 01 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
3. Division 01 Section "Closeout Procedures" for submitting operation and maintenance manuals.
4. Division 01 Section "Project Record Documents" for preparing Record Drawings for operation and maintenance manuals.
5. Divisions 02 through 48 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 SUBMITTALS

A. Initial Submittal: Submit two (2) draft copies of each manual at least fifteen (15) calendar days before requesting inspection for Substantial Completion. Include a complete operation and maintenance directory. Owner will return one copy of draft and mark whether general scope and content of manual are acceptable.

1. In lieu of hard copies, Contractor may submit digital copies in PDF format.

B. Final Submittal: Submit two copies of each manual in final form at least fifteen (15) calendar days before final inspection. Architect will return copy with comments within 15days after final inspection.

1. Submit four (4) sets prior to final inspection, bound in 8-1/2" X 11" binders with durable plastic covers, acceptable to the Owner.
2. In addition, Contractor shall submit digital copy in PDF format.
3. Submit final volumes revised, to the authorized representative of the Owner as required in these Contract Documents.

1.5 COORDINATION

A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Organization: Include a section in the directory for each of the following:

1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 MANUALS, GENERAL

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name, address, and telephone number of Contractor.
6. Name and address of Architect.
7. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

    a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross- reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.

2. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets. These manuals shall include a complete description of all systems and equipment, diagrams indicating connectors, oiling requirements, types of lubricants to be used and method of operating equipment. Included within the manuals shall be a list of names, addresses and telephone numbers of sub- contractors involved in the installation and firms capable of performing services for each mechanical item.
3. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual. Internally subdivide the binders contents

with permanent page dividers, logically organized as described below and with tab titling clearly printed under reinforced laminated plastic tabs.

a. PART 1: Directory, listing names, addresses, contact persons and telephone numbers of Architects, Engineers, Contractors, Subcontractors and suppliers.

b. PART 2: Maintenance instructions subdivided by MasterSpec Format Sections as listed within these Contract Documents. For each Section identify names, addresses, contact persons and telephone numbers of Subcontractors and suppliers. Identify the following (in addition to the items listed in "G" above):

1) Significant design criteria
2) List of equipment.
3) Parts list for each component.
4) Maintenance instructions for equipment and systems.
5) Maintenance instructions for special finishes, including recommended cleaning methods and materials and special precautions identifying detrimental agents.

4. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
5. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
6. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages,

and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions.
2. Performance and design criteria if Contractor is delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUAL

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard printed maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training videotape, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts, Extra Materials and Maintenance Materials

1. Provide products, spare parts, maintenance and extra materials in quantities specified in individual specification sections. If there are no quantities specified then provide a minimum of five percent (5%) of:

    a. all interior finish materials (attic stock).
    b. the number of lamps and ballast needed for every light fixture.
    c. the total number of automatic light sensors
    d. the total number of each filter type required for each Mechanical Unit requiring filters.

2. Provide 100% of all spare parts necessary to operate and maintain all equipment and building systems within the design parameters and/or as recommended by the manufacturer or supplier.
3. Deliver to Owner’s Project Manager and obtain receipt prior to final payment.
4. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Special Tools

1. Provide any “special tools” (one of each type) if required as part of the operation and maintenance of any of the systems herein specified. “Special tools” are devices that are considered unique to a specified system and necessary for maintenance and operation of that system, and not normally part of the maintenance department inventory.

H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

I. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.

1. Do not use original Project Record Documents as part of operation and maintenance manuals.
2. Comply with requirements of newly prepared Record Drawings in Division 01 Section "Project Record Documents."

G. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017820

SECTION 018200 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section. In the event of any conflicts between the requirements of these Sections, the more stringent requirement shall apply.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Demonstration and training videotapes.

B. Related Sections include the following, as applicable to this project:

1. Division 01 Section "Allowances" for administrative and procedural requirements for demonstration and training allowances.
2. Division 01 Section "Project Management and Coordination" for requirements for pre-instruction conferences.
3. Divisions 02 through 48 Sections for specific requirements for demonstration and training for products in those Sections.

C. Allowances: Furnish demonstration and training instruction time under the Demonstration and Training Allowance as specified in Division 01 Section "Allowances."

D. Unit Price for Instruction Time: Length of instruction time will be measured by actual time spent performing demonstration and training in required location. No payment will be made for time spent assembling educational materials, setting up, or cleaning up.

1.3 SUBMITTALS

A. Instruction Program: Submit two (2) copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. At completion of training, submit two (2) complete training manual(s) for Owner's use.

B. Qualification Data: For instructors.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

E. Demonstration and Training Videotapes: Submit two (2) copies within seven (7) days of end of each training module.

1. Identification: On each copy, provide an applied label with the following information:

a. Name of Project.
b. Name and address of photographer.
c. Name of Architect.
d. Name of Contractor.
e. Date videotape was recorded.
f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.

2. Transcript: Prepared on 8-1/2-by-11-inch paper, punched and bound in heavy-duty, 3-ring, vinyl-covered binders. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding videotape. Include name of Project and date of videotape on each page.

1.4 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Control Requirements," experienced in operation and maintenance procedures and training.

C. Photographer Qualifications: A professional photographer who is experienced photographing construction projects.

D. Pre-instruction Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:

1. Inspect and discuss locations and other facilities required for instruction.
2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
3. Review required content of instruction.
4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.5 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.

B. Coordinate instructors, including providing notification of dates, times, length of instruction

time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:

1. Motorized doors, including overhead coiling doors, overhead coiling grilles, and automatic entrance doors.
2. Equipment, including stage equipment, projection screens, loading dock equipment, waste compactors, food-service equipment, residential appliances and laboratory fume hoods, etc.
3. Fire-protection systems, including fire alarm, fire pumps and fire-extinguishing systems.
4. Intrusion detection systems.
5. Conveying systems, including elevators, wheelchair lifts, escalators and cranes.
6. Medical equipment, including medical gas equipment and piping.
7. Laboratory equipment, including laboratory air and vacuum equipment and piping.
8. Heat generation, including boilers, feed water equipment, pumps, steam distribution piping, and water distribution piping.
9. Refrigeration systems, including chillers, cooling towers, condensers, pumps and distribution piping.
10. HVAC systems, including air-handling equipment, air distribution systems and terminal equipment and devices.
11. HVAC instrumentation and controls.
12. Electrical service and distribution, including transformers, switchboards, panel boards, uninterruptible power supplies and motor controls.
13. Packaged engine generators, including transfer switches.
14. Lighting equipment and controls.
15. Communication systems, including intercommunication, surveillance, clocks and programming, voice and data and television equipment.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

    a. System, subsystem, and equipment descriptions.
    b. Performance and design criteria if Contractor is delegated design responsibility.
    c. Operating standards.
    d. Regulatory requirements.
    e. Equipment function.
    f. Operating characteristics.
    g. Limiting conditions.
    h. Performance curves.

2. Documentation: Review the following items in detail:

    a. Emergency manuals.
    b. Operations manuals.
    c. Maintenance manuals.
    d. Project Record Documents.
    e. Identification systems.
    f. Warranties and bonds.
    g. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

    a. Instructions on meaning of warnings, trouble indications, and error messages.
    b. Instructions on stopping.
    c. Shutdown instructions for each type of emergency.
    d. Operating instructions for conditions outside of normal operating limits.
    e. Sequences for electric or electronic systems.
    f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

    a. Startup procedures.
    b. Equipment or system break-in procedures.
    c. Routine and normal operating instructions.
    d. Regulation and control procedures.
    e. Control sequences.
    f. Safety procedures.
    g. Instructions on stopping.
    h. Normal shutdown instructions.
    i. Operating procedures for emergencies.
    j. Operating procedures for system, subsystem, or equipment failure.
    k. Seasonal and weekend operating instructions.
    l. Required sequences for electric or electronic systems.
    m. Special operating instructions and procedures.

5. Adjustments: Include the following:

    a. Alignments.
    b. Checking adjustments.
    c. Noise and vibration adjustments.
    d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

    a. Diagnostic instructions.
    b. Test and inspection procedures.

7. Maintenance: Include the following:

    a. Inspection procedures.
    b. Types of cleaning agents to be used and methods of cleaning.
    c. List of cleaning agents and methods of cleaning detrimental to product.
    d. Procedures for routine cleaning
    e. Procedures for preventive maintenance.
    f. Procedures for routine maintenance.
    g. Instruction on use of special tools.

8. Repairs: Include the following:

    a. Diagnosis instructions.
    b. Repair instructions.
    c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
    d. Instructions for identifying parts and components.
    e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual.

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
2. Owner will furnish an instructor to describe Owner's operational philosophy.
3. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner with at least seven (7) calendar days' advance notice.

D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of an oral and a demonstration performance-based test.

E. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial

training use.

3.3 DEMONSTRATION AND TRAINING VIDEOTAPES

A. General: Engage a qualified commercial photographer to record demonstration and training videotapes. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Videotape Format: Provide high-quality VHS color videotape in full-size cassettes.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.

D. Narration: Describe scenes on videotape by dubbing audio narration off-site after videotape is recorded. Include description of items being viewed. Describe vantage point, indicating location, direction (by compass point), and elevation or story of construction.

E. Transcript: Provide a typewritten transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.

END OF SECTION 018200

SECTION 024119 SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled.

B. Related Requirements:

1. Section 011000 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 015639 "Temporary Tree and Plant Protection" for temporary protection of existing trees and plants that are affected by selective demolition.
3. Section 017300 "Execution" for cutting and patching procedures.
4. Section 013516 "Alteration Project Procedures" for general protection and work procedures for alteration projects.
5. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade improvements not part of selective demolition.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.

C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

B. Engineering Survey: Submit engineering survey of condition of building.

C. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.

D. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

E. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by demolition operations. Submit before Work begins.

F. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

G. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.7 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

1.8 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.9 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. Hazardous Materials: Present in buildings and structures to be selectively demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.

1. Hazardous material remediation is specified elsewhere in the Contract Documents.
2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
3. Owner will provide material safety data sheets for suspected hazardous materials that are known to be present in buildings and structures to be selectively demolished because of building operations or processes performed there.

F. Historic Areas: Demolition and hauling equipment and other materials shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, including temporary protection, by 12 inches more.

G. Storage or sale of removed items or materials on-site is not permitted.

H. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.10 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor before proceeding.

B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

1.11 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Engage a professional engineer to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.

1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

D. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.

E. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

F. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video.

1. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.
2. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 PREPARATION

A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Owner will arrange to shut off indicated services/systems when requested by Contractor.

2. Arrange to shut off utilities with utility companies.
3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.

    a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
    c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
    f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
    g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.4 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

C. Remove temporary barricades and protections where hazards no longer exist.

3.5 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.

3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
5. Maintain fire watch during and for at least 1 hour after flame-cutting operations.
6. Maintain adequate ventilation when using cutting torches.
7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
10. Dispose of demolished items and materials promptly. Comply with requirements in Section 017419 Construction Waste Management and Disposal.

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

C. Work in Historic Areas: Selective demolition may be performed only in areas of Project that are not designated as historic.

D. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

E. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

F. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.

C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.

D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and recycle or dispose of them according to Section 017419 "Construction Waste Management and Disposal."

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

3.8 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations.

END OF SECTION 024119

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.

B. Related Requirements:

1. Section 033543 "Polished Concrete Finishing" for concrete floors scheduled to receive a polished concrete finish.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site

1. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

a. Contractor's superintendent.
b. Concrete Subcontractor.
c. Special concrete finish Subcontractor.

1.5 ACTION SUBMITTALS

A. Product Data: For each of the following.
1. Portland cement.
2. Fly ash.
3. Slag cement.
4. Aggregates.
5. Admixtures:
a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.
6. Vapor retarders.
7. Color pigments
8. Curing materials.
9. Joint fillers.
10. Liquid floor treatments
11. Repair materials.

B. Design Mixtures: For each concrete mixture, include the following:
1. Mixture identification.
2. Minimum 28-day compressive strength.
3. Maximum w/cm.
4. Slump limit.
5. Air content.
6. Nominal maximum aggregate size.
7. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
8. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Shop Drawings:
1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
a. Location of construction joints is subject to approval of the Architect.

D. Samples: For manufacturer's standard colors for color pigment

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:
1. Installer: Include copies of applicable ACI certificates.
2. Ready-mixed concrete manufacturer.
3. Testing agency: Include copies of applicable ACI certificates.

B. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Curing compounds.
4. Vapor retarders.
5. Joint-filler strips.
6. Repair materials.

C. Material Test Reports: For the following, from a qualified testing agency:
1. Portland cement.
2. Fly ash.
3. Slag cement.
4. Aggregates.
5. Admixtures:

D. Floor surface flatness and levelness measurements report, indicating compliance with specified tolerances.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs Project personnel qualified as an ACI-certified Flatwork Technician and Finisher and a supervisor who is a certified ACI Flatwork Concrete Finisher/Technician or an ACI Concrete Flatwork Technician with experience installing and finishing concrete

B. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Laboratory Testing Agency Qualifications: A testing agency qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated and employing an ACI-certified Concrete Quality Control Technical Manager.
1. Personnel performing laboratory tests shall be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

D. Field Quality Control Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.
1. Personnel conducting field tests shall be qualified as an ACI Concrete Field Testing Technician, Grade 1, in accordance with ACI CPP 610.1 or an equivalent certification program.

E. Mockups: Cast concrete slab-on-ground panels to demonstrate typical joints, surface finish, texture, tolerances, floor treatments, and standard of workmanship.
   1. Slab-On-Ground: Build panel approximately 15 feet by 15 feet or as required in the location indicated or, if not indicated, as directed by Architect.
      a. Divide panel into four equal panels to demonstrate saw joint cutting.

   2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI 301

1.9 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1 and as follows.
   1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
   2. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301
   3. Do not use frozen materials or materials containing ice or snow.
   4. Do not place concrete in contact with surfaces less than 35 deg F other than reinforcing steel.
   5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1 and as follows:
   1. Maintain concrete temperature at time of discharge to not exceed 95 deg F
   2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

1.10 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to furnish replacement sheet vapor retarder/termite barrier material and accessories for sheet vapor retarder/ termite barrier and accessories that do not comply with requirements or that fail to resist penetration by termites within specified warranty period.
   1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

A. Source Limitations:
1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
3. Obtain aggregate from single source.
4. Obtain each type of admixture from single source from single manufacturer.

B. Cementitious Materials:
1. Portland Cement: ASTM C150/C150M, Type I/II.
2. Fly Ash: ASTM C618, Class C or F.
3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.

C. Normal-Weight Aggregates: ASTM C33/C33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.
1. Alkali-Silica Reaction: Comply with one of the following:
a. Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C1293.
b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.
c. Alkali Content in Concrete: Not more than 4 lb./cu. ydfor moderately reactive aggregate or 3 lb./cu. ydfor highly reactive aggregate, when tested in accordance with ASTM C1293 and categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with ACI 301
2. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C260/C260M.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride in steel-reinforced concrete.
1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.

3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

F. Water and Water Used to Make Ice: ASTM C94/C94M, potable

G. Color Pigment: ASTM C979/C979M, synthetic mineral-oxide pigments, color stable, nonfading, and resistant to lime and other alkalis.
1. Color: As selected by Architect from manufacturer's full range

2.3 VAPOR RETARDERS

A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A not less than 10 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

2.4 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.
1. Color:
   a. Ambient Temperature Below 50 deg F: Black.
   b. Ambient Temperature between 50 deg F and 85 deg F: Any color.
   c. Ambient Temperature Above 85 deg F : White.

D. Water: Potable or complying with ASTM C1602.

2.5 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber or ASTM D1752, cork or self-expanding cork.

2.6 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand, as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi at 28 days when tested in accordance with ASTM C109/C109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested in accordance with ASTM C109/C109M.

2.7 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.
1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
1. Fly Ash or Other Pozzolans: 25 percent by mass.
2. Slag Cement: 50 percent by mass.
3. Total of Fly Ash or Other Pozzolans, Slag Cement, and Silica Fume: 50 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.
4. Total of Fly Ash or Other Pozzolans and Silica Fume: 35 percent by mass with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.

C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.
1. Use water-reducing, high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, and concrete with a w/cm below 0.50.

2.8 CONCRETE MIXTURES

A. Class A : Normal-weight concrete used for footings and foundation walls.
   1. Exposure Class: ACI 318 F1.
   2. Minimum Compressive Strength: 4000 psi at 28 days.
   3. Maximum w/cm**:** 0.50
   4. Air Content:
      a. Exposure Class F1: 5.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch nominal maximum aggregate size

B. Class **C** : Normal-weight concrete used for interior slabs-on-ground.
   1. Exposure Class: ACI 318 F0.
   2. Minimum Compressive Strength: 3000 psi at 28 days.
   3. Maximum w/cm: 0.55
   4. Minimum Cementitious Materials Content: 540 lb/cu. yd.
   5. Air Content:
      a. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.

2.9 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M[and furnish batch ticket information.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:
   1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.
   2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:
   1. Daily access to the Work.
   2. Incidental labor and facilities necessary to facilitate tests and inspections.
   3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.

4. Security and protection for test samples and for testing and inspection equipment at Project site.

3.3 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.
   1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.

3.4 INSTALLATION OF VAPOR RETARDER

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.
   1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
   2. Face laps away from exposed direction of concrete pour.
   3. Lap vapor retarder over footings and grade beams not less than 6 inches sealing vapor retarder to concrete.
   4. Lap joints 6 inches and seal with manufacturer's recommended tape.
   5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
   6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
   7. Protect vapor retarder during placement of reinforcement and concrete.
      a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides, and sealing to vapor retarder.

3.5 JOINTS

A. Construct joints true to line, with faces perpendicular to surface plane of concrete.

B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.

   1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.

C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:

   1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.

2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.

D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface, where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.

1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.

B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.

C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect in writing, but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.

1. If a section cannot be placed continuously, provide construction joints as indicated.
2. Deposit concrete to avoid segregation.
3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.

a. Do not use vibrators to transport concrete inside forms.
b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Do not place concrete floors and slabs in a checkerboard sequence.
2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
3. Maintain reinforcement in position on chairs during concrete placement.
4. Screed slab surfaces with a straightedge and strike off to correct elevations.
5. Level concrete, cut high areas, and fill low areas.
6. Slope surfaces uniformly to drains where required.
7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
8. Do not further disturb slab surfaces before starting finishing operations.

3.7 FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:

1. ACI 301 Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.
   a. Patch voids larger than 1-1/2 inches wide or 1/2 inch deep.
   b. Remove projections larger than 1 inch
   c. Tie holes do not require patching.
   d. Surface Tolerance: ACI 117 Class D.
   e. Apply to concrete surfaces not exposed to public view.

3.8 FINISHING FLOORS AND SLABS

A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish:

1. While still plastic, texture concrete surface that has been screeded and bull-floated or darbied.

2. Use stiff brushes, brooms, or rakes to produce a profile depth of 1/4 inch (6 mm) in one direction.
3. Apply scratch finish to surfaces to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish:

1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
2. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 (ACI A117M) tolerances for conventional concrete.
3. Apply float finish to surfaces to receive trowel finish.

D. Trowel Finish:

1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
4. Do not add water to concrete surface.
5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
6. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
7. Finish surfaces to the following tolerances, in accordance with ASTM E1155 (ASTM E1155M), for a randomly trafficked floor surface:

    a. Slabs on Ground:

        1) Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed [**1/4 inch (6 mm)**] [**3/16 inch (4.8 mm)**] [**1/8 inch (3 mm)**] [**1/8 inch (3 mm) and)1/16 inch (1.6 mm) in 2 feet (610 mm)**].
        2) Specified overall values of flatness, F_F 35; and of levelness, F_L 25; with minimum local values of flatness, F_F 24; and of levelness, F_L 17. At thin floor covering areas (coordinate extents with architect)
        3) Specified Overall Value (SOV): F_F 50 and F_L 25 with minimum local value (MLV): F_F 40 and F_L 17. At Polished Floor Areas (coordinate extents with architect)

4) Specified Overall Value (SOV): F_F 25 and F_L 20 with minimum local value (MLV): F_F 17 and F_L 15. At Dance Studios (coordinate extents with architect)

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thinset method. While concrete is still plastic, slightly scarify surface with a fine broom perpendicular to main traffic route.

1. Coordinate required final finish with Architect before application.
2. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
2. Coordinate required final finish with Architect before application.

3.9 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:

1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

3.10 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h, calculated in accordance with ACI 305.1, before and during finishing operations.

B. Curing Formed Surfaces: Comply with ACI 308.1 as follows:

1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.

2. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
3. If forms remain during curing period, moist cure after loosening forms.
4. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:
   a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
   b. Continuous Sprinkling: Maintain concrete surface continuously wet.
   c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
   d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
   e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
      1) Recoat areas subject to heavy rainfall within three hours after initial application.
      2) Maintain continuity of coating and repair damage during curing period.

C. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:

1. Begin curing immediately after finishing concrete.
2. Interior Concrete Floors:

   a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:

      1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
         a) Lap edges and ends of absorptive cover not less than 12-inches.
         b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

      2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.
         a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
         b) Cure for not less than seven days.

      3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
         a) Water.
         b) Continuous water-fog spray.

4) Leave curing paper in place for duration of curing period, but not less than 28 days.

b. Floors to Receive Urethane Flooring:
1) As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
2) Rewet absorptive cover, and cover immediately with polyethylene moisture-retaining cover with edges lapped 6 inches and sealed in place.
3) Secure polyethylene moisture-retaining cover in place to prohibit air from circulating under polyethylene moisture-retaining cover.
4) Leave absorptive cover and polyethylene moisture-retaining cover in place for duration of curing period, but not less than 28 days.

3.11 TOLERANCES

A. Conform to ACI 117.

3.12 CONCRETE SURFACE REPAIRS

A. Defective Concrete:

1. Repair and patch defective areas when approved by Architect.
2. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete.
a. Limit cut depth to 3/4 inch.
b. Make edges of cuts perpendicular to concrete surface.
c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
d. Fill and compact with patching mortar before bonding agent has dried.
e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement, so that, when dry, patching mortar matches surrounding color.
a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.

b. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces:

1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.

   a. Correct low and high areas.
   b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

2. Repair finished surfaces containing surface defects, including spalls, popouts, honeycombs, rock pockets, crazing, and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
3. After concrete has cured at least 14 days, correct high areas by grinding.
4. Correct localized low areas during, or immediately after, completing surface-finishing operations by cutting out low areas and replacing with patching mortar.
   a. Finish repaired areas to blend into adjacent concrete.

5. Correct other low areas scheduled to receive floor coverings with a repair underlayment.
   a. Prepare, mix, and apply repair underlayment and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
   b. Feather edges to match adjacent floor elevations.

6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete.
   a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch clearance all around.
   b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
   c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
   d. Place, compact, and finish to blend with adjacent finished concrete.
   e. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar.
   a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
   b. Dampen cleaned concrete surfaces and apply bonding agent.
   c. Place patching mortar before bonding agent has dried.
   d. Compact patching mortar and finish to match adjacent concrete.
   e. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.13 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.

B. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.

C. Inspections:
1. Headed bolts and studs.
2. Verification of use of required design mixture.
3. Concrete placement, including conveying and depositing.
4. Curing procedures and maintenance of curing temperature.
5. Verification of concrete strength before removal of shores and forms from beams and slabs.

D. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M shall be performed in accordance with the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
   a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C143/C143M:
   a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
   b. Perform additional tests when concrete consistency appears to change.

3. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete;.
   a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

4. Concrete Temperature: ASTM C1064/C1064M:
   a. One test hourly when air temperature is 40 deg F (4.4 deg C) and below or 80 deg F (27 deg C) and above, and one test for each composite sample.

5. Compression Test Specimens: ASTM C31/C31M:
   a. Cast and laboratory cure two sets of three 6-inch (150 mm) by 12-inch (300 mm) or 4-inch (100 mm) by 8-inch (200 mm) cylinder specimens for each composite sample.

6. Compressive-Strength Tests: ASTM C39/C39M.
   a. Test one set of three laboratory-cured specimens at seven days and one set of two specimens at 28 days.
   b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa) if specified compressive strength is 5000 psi (34.5 MPa), or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi (34.5 MPa).
8. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
9. Additional Tests:
   a. Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
   b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.

      1) Acceptance criteria for concrete strength shall be in accordance with ACI 301 (ACI 301M), section 1.6.6.3.

10. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
11. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

E. Measure floor and slab flatness and levelness in accordance with ASTM E1155 (ASTM E1155M) within 48 hours of completion of floor finishing and promptly report test results to Architect.

3.14 PROTECTION

A. Protect concrete surfaces as follows:

1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
3. Prohibit vehicles from interior concrete slabs.

4. Prohibit use of pipe-cutting machinery over concrete surfaces.
5. Prohibit placement of steel items on concrete surfaces.
6. Prohibit use of acids or acidic detergents over concrete surfaces.

END OF SECTION 033000

SECTION 033543 - POLISHED CONCRETE FINISHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Polished concrete finishing, including staining and scoring.
2. Concrete for polished concrete, including concrete materials, mixture design, placement procedures, initial finishing, and curing is specified in Section 033000 "Cast-in-Place Concrete."

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for concrete not designated as polished concrete.

1.3 DEFINITIONS

A. Design Reference Sample: Sample designated by Architect in the Contract Documents that reflects acceptable surface quality and appearance of polished concrete.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with polished concrete to attend, including the following:

a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete manufacturer.
d. Cast-in-place concrete subcontractor.
e. Polished concrete finishing Subcontractor.

2. Review construction joints, concrete finishing, and protection of polished concrete.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Polishing Schedule: Submit plan showing polished concrete surfaces and schedule of polishing operations for each area of polished concrete before start of polishing operations. Include locations of all joints, including construction joints.

C. Samples for Initial Selection: Submit samples of manufacturer's available colors for selection.

D. Samples for Verification: For each type of exposed color.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Material Certificates: For each of the following, signed by manufacturers:

1. Repair materials.
2. Stain materials.
3. Liquid floor treatments.

1.7 QUALITY ASSURANCE

A. Field Sample Panels: After approval of verification sample and before casting concrete, produce field sample panels to demonstrate the approved range of selections made under Sample submittals. Produce a minimum of three sets of full-scale panels, approximately 48 by 48 inches (1200 by 1200 mm) minimum, to demonstrate the expected range of finish, color, and appearance variations.

1. Locate panels as directed by Architect.
2. Maintain field sample panels during construction in an undisturbed condition as a standard for judging the completed Work.
3. Demolish and remove field sample panels when directed.

B. Mockups: Before casting concrete, build mockups to verify selections made under Sample submittals and to demonstrate typical joints, surface finish, tolerances, and standard of workmanship. Build mockups to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.

2. Demonstrate curing, finishing, and protecting of polished concrete.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 FIELD CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 STAIN MATERIALS

A. Penetrating Stain: Water-based, acrylic latex, penetrating stain with colorfast pigments.

1. Basis of Design: Scofield Formula One Liquid Dye Concentrate.

2.2 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatments for Polished Concrete Finish: Clear, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and is suitable for polished concrete surfaces.

1. Product as recommended by manufacturer, compatible with penetrating stain.

PART 3 - EXECUTION

3.1 POLISHING

A. Polish: Match design reference sample.

B. Apply polished concrete finish system to cured and prepared slabs to match accepted mockup.

1. Machine grind floor surfaces to receive polished finishes level and smooth.
2. Apply reactive stain for polished concrete in polishing sequence and according to manufacturer's written instructions.
3. Apply penetrating liquid floor treatment for polished concrete in polishing sequence and according to manufacturer's written instructions, allowing recommended drying time between successive coats.
4. Apply penetrating stain for polished concrete in polishing sequence and according to manufacturer's written instructions.

5. Continue polishing with progressively finer-grit diamond polishing pads to gloss level, to match approved mockup.
6. Control and dispose of waste products produced by grinding and polishing operations.
7. Neutralize and clean polished floor surfaces.

3.2 STAINING

A. Newly placed concrete shall be at least 30 days old before staining or as recommended by manufacturer.

B. Prepare surfaces according to manufacturer's written instructions.

C. Allow concrete surface to dry before applying stain. Verify readiness of concrete to receive stain according to ASTM D4263 by tightly taping 18-by-18-inch (450-by-450-mm), 4-mil- (0.1-mm-) thick polyethylene sheet to a representative area of concrete surface. Apply stain only if no evidence of moisture has accumulated under sheet after 16 hours.

D. Reactive Stain: Apply reactive stain to concrete surfaces according to manufacturer's written instructions .

E. Penetrating Stain: Apply penetrating stain to concrete surfaces according to manufacturer's written instructions.

END OF SECTION 033543

SECTION 034100 - PRECAST STRUCTURAL CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Precast structural concrete.
   2. Precast structural concrete with commercial architectural finish.

B. Related Requirements:

   1. Section 033000 "Cast-in-Place Concrete" for placing connection anchors in concrete.
   2. Section 051200 "Structural Steel Framing" for furnishing and installing connections attached to structural-steel framing.
   3. Section 055000 "Metal Fabrications" for kickers and other miscellaneous steel shapes.

1.3 DEFINITIONS

A. Design Reference Sample: Sample of approved precast structural concrete color, finish, and texture, preapproved by Architect.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each precast concrete mixture. Include compressive strength and, if required, water-absorption tests.

C. Shop Drawings:

   1. Include member locations, plans, elevations, dimensions, shapes and sections, openings, support conditions, and types of reinforcement, including special reinforcement.
   2. Detail fabrication and installation of precast structural concrete units, including connections at member ends and to adjoining construction.
   3. Indicate joints, reveals, drips, chamfers, and extent and location of each surface finish.

4. Indicate separate face and backup mixture locations and thicknesses.
5. Indicate type, size, and length of welded connections by AWS standard symbols.
6. Detail loose and cast-in hardware, lifting and erection inserts, connections, and joints.
7. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.
8. Include and locate openings larger than 10 inches (250 mm). Where additional structural support is required, include header design.
9. Indicate location of each precast structural concrete unit by same identification mark placed on panel.
10. Indicate relationship of precast structural concrete units to adjacent materials.
11. Indicate shim sizes and grouting sequence.
12. If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.

D. Samples:

1. For each type of finish indicated on exposed surfaces of precast structural concrete units with architectural finish, in sets of three, representative of finish, color, and texture variations expected; approximately 12 by 12 by 2 inches.

    a. Where other faces of precast concrete unit are exposed, include Samples illustrating workmanship, color, and texture of backup concrete as well as facing concrete.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For installer and fabricator.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm that assumes responsibility for engineering precast structural concrete units to comply with performance requirements. Responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

1. Designated as a PCI-certified plant as follows:
    a. Group CA

B. Installer Qualifications: A precast concrete erector qualified and designated by PCI's Certificate of Compliance, to erect Category S1 - Simple Structural Systems.

C. Testing Agency Qualifications: Qualified according to ASTM C1077 and ASTM E329 for testing indicated.

D. Quality-Control Standard: For manufacturing procedures, testing requirements, and quality-control recommendations for types of units required, comply with PCI MNL 116, "Manual for Quality Control for Plants and Production of Structural Precast Concrete Products."

E. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.4/D1.4M, "Structural Welding Code - Reinforcing Steel."

F. Sample Panels: After sample approval and before fabricating precast structural concrete units with architectural finish, produce a minimum of two sample panels approximately 16 sq. ft. in area for review by Architect. Incorporate full-scale details of architectural features, finishes, textures, and transitions in sample panels.

1. Locate panels where indicated or, if not indicated, as directed by Architect.
2. Damage part of an exposed-face surface for each finish, color, and texture, and demonstrate adequacy of repair techniques proposed for repair of surface blemishes.
3. After approval of repair technique, maintain one sample panel at fabricator's plant and one at Project site in an undisturbed condition as a standard for judging the completed Work.
4. Demolish and remove sample panels when directed.
5. Approval of sample panel does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.7 COORDINATION

A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction before starting that Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Support units during shipment on nonstaining shock-absorbing material in same position as during storage.

B. Store units with adequate bracing and protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping or other physical damage.

1. Store units with dunnage across full width of each bearing point unless otherwise indicated.
2. Place adequate dunnage of even thickness between each unit.
3. Place stored units so identification marks are clearly visible, and units can be inspected.

C. Handle and transport units in a manner that avoids excessive stresses that cause cracking or damage.

D. Lift and support units only at designated points indicated on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Universal Concrete Products, 400 Old Reading Pike, Suite 100, Stowe, PA 19464. 610-323-0700

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section014000 "Quality Requirements," to design precast structural concrete units

B. Design Standards: Comply with ACI 318 (ACI 318M) and with design recommendations in PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of precast structural concrete units indicated.

C. Structural Performance: Precast structural concrete units and connections shall withstand design loads indicated within limits and under conditions indicated.

1. Design precast structural concrete framing system and connections to maintain clearances at openings, to allow for fabrication and construction tolerances, to accommodate live-load deflection, shrinkage and creep of primary building structure, and other building movements. Maintain precast structural concrete deflections within limits of ACI 318 (ACI 318M).

a. Thermal Movements: Allow for in-plane thermal movements resulting from annual ambient temperature changes .

2.3 MOLD MATERIALS

A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that provides continuous precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.

1. Mold-Release Agent: Commercially produced form-release agent that does not bond with, stain, or adversely affect precast concrete surfaces and does not impair subsequent surface or joint treatments of precast concrete.

B. Form Liners: Units of face design, texture, arrangement, and configuration indicated. Furnish with manufacturer's recommended form-release agent that does not bond with, stain, or adversely affect precast concrete surfaces and does not impair subsequent surface or joint treatments of precast concrete.

C. Surface Retarder: Chemical set retarder, capable of temporarily delaying setting of newly placed concrete mixture to depth of reveal specified.

2.4 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A615/A615M, Grade 60 (Grade 420), deformed.

B. Steel Bar Mats: ASTM A184/A184M, fabricated from ASTM A615/A615M, Grade 60, deformed bars, assembled with clips.

C. Plain-Steel Welded Wire Reinforcement: ASTM A185/A185M, fabricated from as-drawn steel wire into flat sheets.

D. Deformed-Steel Welded Wire Reinforcement: ASTM A497/A497M or ASTM A1064/A1064M, flat sheet.

E. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 116.

2.5 PRESTRESSING TENDONS

A. Pretensioning Strand: ASTM A416/A416M, Grade 250 or Grade 270, uncoated, seven-wire low-relaxation strand.

B. Unbonded Post-Tensioning Strand: ASTM A416/A416M, Grade 270, uncoated, seven-wire, low-relaxation strand.

C. Post-Tensioning Bars: ASTM A722/A722M, uncoated high-strength steel bar.

2.6 CONCRETE MATERIALS

1. Portland Cement: ASTM C150/C150M, Type I or Type III, mix to be composed of white cement with local aggregates to match Architects control sample. For surfaces exposed to view in finished structure, use white cement, of same type, brand, and mill source.

B. Supplementary Cementitious Materials:

1. Fly Ash: ASTM C618, Class C or F, with maximum loss on ignition of 3 percent.
2. Metakaolin: ASTM C618, Class N.
3. Ground Granulated Blast-Furnace Slag: ASTM C989, Grade 100 or 120.

C. Normal-Weight Aggregates: Except as modified by PCI MNL 116, ASTM C33/C33M, with coarse aggregates. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.

1. Face-Mixture-Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining; to match selected finish sample.

a. Gradation: To match design reference sample.

2. Face-Mixture-Fine Aggregates: Selected, natural or manufactured sand compatible with coarse aggregate to match approved finish sample.

D. Coloring Admixture: ASTM C979/C979M, synthetic or natural mineral-oxide pigments or colored water-reducing admixtures, temperature stable, and nonfading as required to match Architects sample.

E. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 116.

F. Air-Entraining Admixture: ASTM C260, certified by manufacturer to be compatible with other required admixtures.

G. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture.

1. Water-Reducing Admixtures: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
4. Water-Reducing and Accelerating Admixture: ASTM C494/C494M, Type E.
5. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
6. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
7. Plasticizing Admixture: ASTM C1017/C1017M, Type I.
8. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.
9. Corrosion-Inhibiting Admixture: ASTM C1582/C1582M.

2.7 STEEL CONNECTION MATERIALS

A. Carbon-Steel Shapes and Plates: ASTM A36/A36M.

B. Carbon-Steel-Headed Studs: ASTM A108, Grade 1010 through 1020, cold finished, AWS D1.1/D1.1M, Type A or B, with arc shields and with minimum mechanical properties of PCI MNL 116.

C. Carbon-Steel Plate: ASTM A283/A283M, Grade C.

D. Malleable-Iron Castings: ASTM A47/A47M, Grade 32510 or Grade 35028.

E. Carbon-Steel Castings: ASTM A27/A27M, Grade 60-30 (Grade 415-205).

F. High-Strength, Low-Alloy Structural Steel: ASTM A572/A572M.

G. Carbon-Steel Structural Tubing: ASTM A500/A500M, Grade B or Grade C.

H. Wrought Carbon-Steel Bars: ASTM A675/A675M, Grade 65 (Grade 450).

I. Deformed-Steel Wire or Bar Anchors: ASTM A496/A496M or ASTM A706/A706M.

J. Carbon-Steel Bolts and Studs: ASTM A307, Grade A (ASTM F568M, Property Class 4.6); carbon-steel, hex-head bolts and studs; carbon-steel nuts, ASTM A563 (ASTM A563M); and flat, unhardened steel washers, ASTM F844.

K. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M,Grade A325 (Grade A325M), Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, (ASTM A563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.

1. Finish: Plain.

L. Welding Electrodes: Comply with AWS standards.

M. Precast Accessories: Provide clips, hangers, plastic or steel shims, and other accessories required to install precast structural concrete units.

2.8 BEARING PADS

A. Provide one of the following bearing pads for precast structural concrete units as recommended by precast fabricator for application:

1. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, 50 to 70 Shore, Type A durometer hardness, ASTM D2240; minimum tensile strength 2250 psi (15.5 MPa), ASTM D412.
2. Random-Oriented-Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. 70 to 90 Shore, Type A durometer hardness, ASTM D2240; capable of supporting a compressive stress of 3000 psi (20.7 MPa) with

no cracking, splitting, or delaminating in the internal portions of pad. Test one specimen for every 200 pads used in Project.

3. Cotton-Duck-Fabric-Reinforced Elastomeric Pads: Preformed, horizontally layered cotton-duck fabric bonded to an elastomer; 80 to 100 Shore, Type A durometer hardness, ASTM D2240; complying with AASHTO's "AASHTO LRFD Bridge Design Specifications," Division II, Section 18.10.2; or with MIL-C-882E.
4. Frictionless Pads: PTFE, glass-fiber reinforced, bonded to stainless or mild-steel plate, or random-oriented-fiber-reinforced elastomeric pads; of type required for in-service stress.
5. High-Density Plastic: Multimonomer, nonleaching, plastic strip.

2.9 ACCESSORIES

A. Reglets: Specified in Section 076200 "Sheet Metal Flashing and Trim."

B. Precast Accessories: Provide clips, hangers, high-density plastic or steel shims, and other accessories required to install structural precast concrete units.

2.10 GROUT MATERIALS

A. Sand-Cement Grout: Portland cement, ASTM C150/C150M, Type I, and clean, natural sand, ASTM C144 or ASTM C404. Mix at ratio of 1 part cement to 2-1/2 to 3 parts sand, by volume, with minimum water required for placement and hydration. Water-soluble chloride ion content less than 0.06 percent by weight of cement when tested according to ASTM C1218/C1218M.

B. Nonmetallic, Nonshrink Grout: Packaged, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C1107/C1107M, Grade A for drypack and Grades B and C for flowable grout and of consistency suitable for application within a 30-minute working time. Water-soluble chloride ion content less than 0.06 percent by weight of cement when tested according to ASTM C1218/C1218M.

C. Epoxy-Resin Grout: Two-component, mineral-filled epoxy resin; ASTM C881/C881M, of type, grade, and class to suit requirements.

2.11 INSULATED FLAT-WALL PANEL ACCESSORIES

A. Extruded-Polystyrene Board Insulation: ASTM C578, Type IV, 1.55 lb/cu. ft. (26 kg/cu. m ship-lap edges; with thickness of three inches.

B. Wythe Connectors: Manufactured to connect wythes of precast concrete panels.

2.12 CONCRETE MIXTURES

A. Prepare design mixtures for each type of precast concrete required.

B. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at precast structural concrete fabricator's option.

C. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 (ACI 318M) or PCI MNL 116 when tested according to ASTM C1218/C1218M.

D. Normal-Weight Concrete Mixtures: Proportion face and backup mixtures or full-depth mixtures, at fabricator's option by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:

1. Minimum Compressive Strength (28 Days): 5000 psi.
2. Maximum Water-Cementitious Materials Ratio: 0.45.

E. Water Absorption: For structural precast concrete with an architectural finish, limit water absorption to 6 percent by weight or 14 percent by volume, tested according to ASTM C642, except for boiling requirement.

F. Lightweight Concrete Backup Mixtures: Proportion mixtures by either laboratory trial batch or field test data methods according to ACI 211.2, with materials to be used on Project, to provide lightweight concrete with the following properties:

1. Minimum Compressive Strength (28 Days): 5000 psi.
2. Unit Weight: Calculated equilibrium unit weight of 115 lb/cu. ft. , plus or minus 3 lb/cu. ft., according to ASTM C567.

G. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 116.

H. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.

I. Concrete Mix Adjustments: Concrete mix design adjustments may be proposed if characteristics of materials, Project conditions, weather, test results, or other circumstances warrant.

2.13 MOLD FABRICATION

A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing and detensioning operations. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.

1. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and supports to maintain stability of liners during concrete placement. Coat form liner with form-release agent.

B. Maintain molds to provide completed precast structural concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.
   1. Form joints are not permitted on faces of structural precast concrete with an architectural finish that is exposed to view in the finished work.
   2. Edge and Corner Treatment: Uniformly chamfered as recommended by precast concrete manufacturer.

2.14 FABRICATION

A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.

   1. Weld-headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4, "Recommended Practices for Stud Welding."

B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing precast structural concrete units to supporting and adjacent construction.

C. Cast-in reglets, slots, holes, and other accessories in precast structural concrete units as indicated on the Contract Drawings.

D. Cast-in openings larger than 10 inches (250 mm) in any dimension. Do not drill or cut openings or prestressing strand without Architect's approval.

E. Reinforcement: Comply with recommendations in PCI MNL 116 for fabricating, placing, and supporting reinforcement.

   1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy-coated reinforcement exceeds limits specified in ASTM A775/A775M, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
   2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.
   3. Place reinforcing steel and prestressing strand to maintain at least 3/4-inch (19-mm) minimum concrete cover. Increase cover requirements for reinforcing steel to 1-1/2 inches (38 mm) when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement

in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.

4. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh spacing and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.

F. Reinforce precast structural concrete units to resist handling, transportation, and erection stresses and specified in-place loads.

G. Prestress tendons for precast structural concrete units by either pretensioning or post-tensioning methods. Comply with PCI MNL 116.

1. Delay detensioning or post-tensioning of precast, prestressed structural concrete units until concrete has reached its indicated minimum design release compressive strength as established by test cylinders cured under same conditions as concrete unit.
2. Detension pretensioned tendons either by gradually releasing tensioning jacks or by heat cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.
3. If concrete has been heat cured, detension while concrete is still warm and moist to avoid dimensional changes that may cause cracking or undesirable stresses.
4. Protect strand ends and anchorages with bituminous, zinc-rich, or epoxy paint to avoid corrosion and possible rust spots.
5. Protect strand ends and anchorages with a minimum of 1-inch- (25-mm-) thick, nonmetallic, nonshrink, grout mortar and sack rub surface. Coat or spray the inside surfaces of pocket with bonding agent before installing grout.

H. Comply with requirements in PCI MNL 116 and in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.

I. Place face mixture to a minimum thickness after consolidation of the greater of 1 inch (25 mm) or 1.5 times the maximum aggregate size, but not less than the minimum reinforcing cover specified.

J. Place concrete in a continuous operation to prevent cold joints or planes of weakness from forming in precast concrete units.

1. Place backup concrete mixture to ensure bond with face-mixture concrete.

K. Thoroughly consolidate placed concrete by vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air voids on surfaces. Use equipment and procedures complying with PCI MNL 116.

L. Comply with PCI MNL 116 procedures for hot- and cold-weather concrete placement.

M. Identify pickup points of precast structural concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each precast structural concrete unit on a surface that does not show in finished structure.

N. Cure concrete, according to requirements in PCI MNL 116, by moisture retention without heat or by accelerated heat curing using live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.

O. Discard and replace precast structural concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 116 and meet Architect's approval.

2.15 CASTING INSULATED WALL PANELS

A. Cast, screed, and consolidate wythe supported by mold.

B. Place insulation boards abutting edges and ends of adjacent boards. Insert wythe connectors through insulation, and consolidate concrete around connectors according to connector manufacturer's written instructions.

C. Ensure bottom wythe and insulation layer are not disturbed after bottom wythe reaches initial set.

D. Cast, screed, and consolidate top wythe to meet required finish.

E. Maintain temperature below 150 deg F (65 deg C) in bottom concrete wythe.

2.16 FABRICATION TOLERANCES

A. Fabricate precast structural concrete units to shapes, lines, and dimensions indicated so each finished unit complies with PCI MNL 116 product dimension tolerances as well as position tolerances for cast-in items.

2.17 COMMERCIAL FINISHES

A. Grade B Finish for interior face of structural panels: Fill air pockets and holes larger than 1/4 inch (6 mm) in diameter with sand-cement paste matching color of adjacent surfaces. Fill air holes greater than 1/8 inch (3 mm) in width that occur more than once per 2 sq. in. (1300 sq. mm). Grind smooth form offsets or fins larger than 1/8 inch (3 mm). Repair surface blemishes due to holes or dents in molds. Discoloration at form joints is permitted.

B. Screed or float finish unformed surfaces. Strike off and consolidate concrete with vibrating screeds to a uniform finish. Hand screed at projections. Normal color variations, minor indentations, minor chips, and spalls are permitted. Major imperfections, honeycombing, or defects are not permitted.

C. Smooth, steel trowel finish unformed surfaces. Consolidate concrete, bring to proper level with straightedge, float, and trowel to a smooth, uniform finish.

2.18 COMMERCIAL ARCHITECTURAL FINISHES

A. Manufacture member faces free of joint marks, grain, and other obvious defects with corners, including false joints, uniform and straight. Finish exposed-face surfaces of precast concrete units to match approved sample panel sand as follows:
   1. As-Cast-Surface Finish: Provide surfaces to match approved sample or mockup for acceptable surface, air voids, sand streaks, and honeycomb.

2.19 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to evaluate precast structural concrete fabricator's quality-control and testing methods.

   1. Allow testing agency access to material storage areas, concrete production equipment, concrete placement, and curing facilities. Cooperate with testing agency and provide samples of materials and concrete mixtures as may be requested for additional testing and evaluation.

B. Testing: Test and inspect precast structural concrete according to PCI MNL 116 requirements and ASTM C1610/C1610M, ASTM C1611/C1611M, ASTM C1621/C1621M, and ASTM C1712/C1712M.

C. Strength of precast structural concrete units is considered deficient if units fail to comply with ACI 318 (ACI 318M) requirements for concrete strength.

D. If there is evidence that strength of precast concrete units may be deficient or may not comply with ACI 318 (ACI 318M) requirements, employ a qualified testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C42/C42M.

   1. A minimum of three representative cores shall be taken from units of suspect strength, from locations directed by Architect.
   2. Test cores in an air-dry condition or, if units are wet under service conditions, test cores after immersion in water in a wet condition.
   3. Strength of concrete for each series of three cores is considered satisfactory if average compressive strength is equal to at least 85 percent of 28-day design compressive strength and no single core is less than 75 percent of 28-day design compressive strength.
   4. Report test results in writing on same day that tests are performed, with copies to Architect, Contractor, and precast concrete fabricator. Test reports include the following:

      a. Project identification name and number.
      b. Date when tests were performed.

c. Name of precast concrete fabricator.
d. Name of concrete testing agency.
e. Identification letter, name, and type of precast concrete unit(s) represented by core tests; design compressive strength; type of break; compressive strength at breaks, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.

E. Patching: If core test results are satisfactory and precast structural concrete units comply with requirements, clean and dampen core holes and solidly fill with same precast concrete mixture that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.

F. Defective Units: Discard and replace precast structural concrete units that do not comply with requirements, including strength, manufacturing tolerances, and color and texture range. Chipped, spalled, or cracked units may be repaired, subject to Architect's approval. Architect reserves the right to reject precast units that do not match approved samples, sample panels, and mockups. Replace unacceptable units with precast concrete units that comply with requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, bearing surface tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Do not install precast concrete units until supporting, cast-in-place concrete has attained minimum allowable design compressive strength and until supporting steel or other structure is structurally ready to receive loads from precast concrete units.

3.2 INSTALLATION

A. Install clips, hangers, bearing pads, and other accessories required for connecting precast structural concrete units to supporting members and backup materials.

B. Erect precast structural concrete level, plumb, and square within specified allowable tolerances. Provide temporary structural framing, shoring, and bracing as required to maintain position, stability, and alignment of units until permanent connections are complete.

1. Install temporary steel or plastic spacing shims or bearing pads as precast structural concrete units are being erected. Tack weld steel shims to each other to prevent shims from separating.

2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
3. Remove projecting lifting devices and use plastic patch caps or sand-cement grout to fill voids within recessed lifting devices flush with surface of adjacent precast surfaces when recess is exposed.

C. Connect precast structural concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.

1. Do not permit connections to disrupt continuity of roof flashing.

D. Field cutting of precast units is not permitted without approval of Architect.

E. Fasteners: Do not use drilled or powder-actuated fasteners for attaching accessory items to precast, prestressed concrete units.

F. Welding: Comply with applicable requirements in AWS D1.1/D1.1M and AWS D1.4/D1.4M for welding, welding electrodes, appearance, quality of welds, and methods used in correcting welding work.

1. Protect precast structural concrete units and bearing pads from damage by field welding or cutting operations, and provide noncombustible shields as required.
2. Clean weld-affected steel surfaces with chipping hammer followed by brushing, and reprime damaged painted surfaces.
3. Visually inspect welds and remove, reweld, or repair incomplete and defective welds.

G. At bolted connections, use lock washers, tack welding, or other approved means to prevent loosening of nuts after final adjustment.

1. Where slotted connections are used, verify bolt position and tightness. For sliding connections, properly secure bolt but allow bolt to move within connection slot.
2. For slip-critical connections, use one of the following methods to assure proper bolt pretension:

    a. Turn-of-Nut: According to RCSC's "Specification for Structural Joints Using ASTM A325 or A 490 Bolts."
    b. Calibrated Wrench: According to RCSC's "Specification for Structural Joints Using ASTM A325 or A 490 Bolts."
    c. Twist-off Tension Control Bolt: ASTM F3125/F3125M, Grade 1852.
    d. Direct-Tension Control Bolt: ASTM F3125/F3125M, Grade 1852.

3. For slip-critical connections, use method and inspection procedure approved by Architect and coordinated with inspection agency.

H. Grouting or Dry-Packing Connections and Joints: Grout connections and joints and open spaces at keyways, connections, and joints where required or indicated on Shop Drawings. Retain

flowable grout in place until hard enough to support itself. Alternatively, pack spaces with stiff dry-pack grout material, tamping until voids are completely filled.

1. Place grout and finish smooth, level, and plumb with adjacent concrete surfaces.
2. Fill joints completely without seepage to other surfaces.
3. Trowel top of grout joints on roofs smooth and uniform. Finish transitions between different surface levels not steeper than 1 to 12.
4. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.
5. Keep grouted joints damp for not less than 24 hours after initial set.

3.3 ERECTION TOLERANCES

A. Erect precast structural concrete units level, plumb, square, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 135.

B. Minimize variations between adjacent slab members by jacking, loading, or other method recommended by fabricator and approved by Architect.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Erection of precast structural concrete members.
2. Per 2018 NJ Building Code Chapter 17.

3.5 REPAIRS

A. Repair precast structural concrete units if permitted by Architect.

1. Repairs may be permitted if structural adequacy, serviceability, durability, and appearance of units have not been impaired.

B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet (6 m).

C. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.

D. Remove and replace damaged precast structural concrete units that cannot be repaired or when repairs do not comply with requirements as determined by Architect.

3.6 CLEANING

A. Clean mortar, plaster, fireproofing, weld slag, and other deleterious material from concrete surfaces and adjacent materials immediately.

B. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.

1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's written recommendations. Protect other work from staining or damage due to cleaning operations.
2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION 034100

SECTION 042000 UNIT MASONRY

Part 1 GENERAL

1.1 RELATED DOCUMENTS

A. Applicable Sections: Division 1.

B. Inspection and Testing of Masonry: Division 1.

C. Exterior Enclosure, General: Division 7.

D. Building Insulation: Division 7.

E. Air/Vapor Barriers: Division 7.

F. Flashing and Sheet Metal: Division 7.

G. Joint Sealants: Division 7.

1.2 SUMMARY (NON-INCLUSIVE)

A. Section Includes: Manufactured unit masonry for Project, including concrete masonry units and accessories related to unit masonry work, for example, mortar, reinforcement and anchorage.

1.3 SUBMITTALS

A. Submit per the requirements of Division 1.

B. Product Data:

1. Mortar Mix Designs: As indicated.

2. Cold and hot weather construction procedures.

C. Shop Drawings:

1. Reinforcement Placement Drawings: For each piece of reinforcing bar larger than a No. 3.

1.4 DEFINITIONS

A. Control Joints:

1. Creates an open plane in wythe to allow initial expansion.

B. Expansion Joints: A continuous break in entire structure of building and are not necessarily specified in this Section. Note that Brick Institute of America and other similar technical organizations use term "expansion joint" for control joints in brick and tile. When interpreting required reference standards, it is Contractor's responsibility to coordinate meaning of each term with its appropriate usage in Specifications.

1.5 QUALITY ASSURANCE

A. Work of this Section shall be subject to review, inspection and approval of Owner's Representative. Inspection and Testing, including reports and certifications are responsibility of Contractor. Perform Inspection and Testing

in accordance with Division 1. Owner reserves right to verify all tests with Owner's independent Inspection and Testing Agency.

B. Manufacturer's Qualifications: Manufacturer of each unit masonry product shall have a minimum ten (10) years' experience. Company shall demonstrate through written third-party documentation successful completion of five (5) projects of similar scope and complexity in last three (3) years.

C. Mason's Qualifications: Installer of unit masonry shall be a company specializing in performing Work of this Section with minimum five (5) years' experience. Company shall demonstrate through written third-party documentation successful completion of five (5) projects of similar scope and complexity in last three (3) years.

D. Accessory Manufacturer's Qualifications: Manufacturer of each accessory product shall be a company specializing in manufacture of products specified in this Section with minimum five (5) years' experience. Company shall demonstrate through written third-party documentation successful completion of five (5) projects of similar scope and complexity in last three (3) years.

E. Single Source Requirements: Each of types of products and materials listed below shall be furnished by a single manufacturer for entire Project.

1. CMU
2. Reinforcement, Ties and Anchors.
3. Mortar and Grout Materials including Pigments and Admixtures.
4. Cleaning Agent.

F. Referenced Codes and Standards: Comply with the following per requirements of Division 1.

1. Brick Institute of America (BIA): "Technical Notes"
2. Portland Cement Association (PCA): "Concrete Masonry Handbook"

G. Regulatory Requirements:

1. Comply with technical requirements of ACI530.1/ASCE6" Specifications for Masonry Structures" except for any requirements which may conflict with responsibilities of Contractor, Owner and Design Professional as required by Conditions of Contract and other Specification Sections.

1.6 DELIVERY, HANDLING AND STORAGE

A. Prior to delivery, pack special units such as ground face and glazed units, in such manner as to protect faces and edges from damage.

B. Deliver masonry materials to Project Site in undamaged condition.

C. Store and handle masonry units off ground, under cover, and in a dry location to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, and other causes. If units become wet, do not place until units are in an air-dried condition.

D. Store cementitious materials off ground, under cover, and in a dry location.

E. Store aggregates on tarps, paving or other hard, clean surface where grading and other required characteristics can be maintained, and contamination avoided.

F. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 FIELD CONDITIONS

A. Cold-Weather Construction: Comply with ACI 530-unit masonry standard for cold-weather construction and the following:

1. Do not lay masonry units that are wet or frozen.
2. Remove masonry damaged by freezing conditions.

B. Hot-Weather Construction: Comply with ACI 530 referenced unit masonry standard for hot-weather construction.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry
3. Protect sills, ledges, and projections from mortar droppings.
4. Protect surfaces of window and doorframes, as well as similar products with painted and integral finishes, from mortar droppings.
5. Monitor other trades as they come in contact with masonry as to perform their work without damaging masonry. Masonry Contractor shall provide additional protection materials to other trades prior to trades starting their work. Replace masonry if damaged by other trades.

Part 2 PRODUCTS

2.1 MATERIALS, GENERAL

A. Provide recycled content materials in accordance with Sustainability Action Plan specified in Sustainability Requirements: Division 1.

B. Extract and manufacture within 500 miles {800 km} of Project Site.

C. Use admixtures that comply with the VOC limits specified in Sustainability Requirements: Division 1.

D. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

E. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.2 MORTAR

A. Materials:

1. Cementitious materials, admixtures and sand and admixtures shall remain same throughout entire Work where exposed to view.
2. Comply with ASTM C 270 and as indicated. Cementitious materials shall be Portland cement and lime only. Masonry cement is not acceptable.
3. Portland Cement: ASTM C 150, Type I.
4. Sand and Aggregates: ASTM C 144.
5. Lime: ASTM C 207, Type S.
6. Water: Potable public supply and free of detrimental content.

7. Pigment: Mineral oxide pigment, sunfast and lime proof, with specific gravity approximating that of Portland cement. Pigment shall not exceed 5 percent of the weight of Portland cement. Carbon black shall not exceed 2 percent of weight of Portland cement. To achieve color of mortar desired, use colored aggregate alone, or blend with pigment. Acceptable Manufacturers: Solomon, Glen Gery and Essroc.

8. Latex Pointing Mortar Additive: "Laticrete 1776: "Grout Admix" manufactured by Laticrete International, Inc. or approved equivalent.

B. Mortar Mixes:

1. Mortar mixes shall comply with ASTM C 270 as follows:

   a. Type S with a minimum 28-day compressive strength of 1800 psi (75 percent water retention). Proportion shall be one (1) part Portland cement to 1/4 to 1/2 parts hydrated lime. Aggregate ratio shall be 2 1/4 to 3 times sum of separate volumes of cement and lime.
   b. Type M with a minimum 28-day compressive strength of 2500 psi (75 percent water retention). Proportion shall be one (1) part Portland cement to 1/4-part hydrated lime. Aggregate ratio shall be 2 1/4 to 3 times sum of separate volumes of cement and lime.

2. Trial Batches for Masonry Sample Panel and Mock-up Panels: After material sources have been established and approved, mix trial batches of types required in shades and colors. Once mortar ingredient proportions are established for strength and appearance and approved in Sample Panel, maintain same mortar mixture(s) for entire Work.

3. Add mortar color and admixtures in accordance with manufacturer's written recommendations. Ensure uniformity of mix and coloration.

4. Do not use anti-freeze compounds to lower freezing point of mortar.

5. Use mortar within two (2) hours of mixing. Do not re-temper mortar after two (2) hours of mixing.

2.3 GROUT MATERIALS

A. High slump grout complying with ASTM C 476 with the following 28-day compressive strength when tested in accordance with ASTM C 1019:

1. 2000 psi: Grout for ASTM C 90 unit.

2.4 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not uses units where such defects are present, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

2.5 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

2. Provide square edge units for outside corners unless otherwise indicated.

B. CMUs: ASTM C 90.

1. Density Classification: Normal weight unless indicated otherwise.

2. Size (Width): Manufactured to dimensions 3/8 inch (10 mm) less than nominal dimensions.

2.6 TIES AND ANCHORS

A. General:

1. Acceptable manufacturers are listed below. No substitutions.

   a. Blok Lok Limited.
   b. Dur-O-Wal (Basis of Design).
   c. A. A. Wire Products Company.
   d. Heckmann Building Products, Inc.
   e. Hohmann & Barnard, Inc.
   f. Wire-Bond.

2. Materials shall be as listed, unless otherwise indicated:

   a. Stainless Steel: ASTM A 240 stainless steel sheet, ASTM A 276 stainless steel plates, bars and shapes, ASTM A 479 stainless steel wire.

3. Embedment shall be as per ACI 530 and as follows:

   a. Horizontal reinforcing and ties parallel to wythe shall be 2 3/8 for nominal 4 inch wythes and 2 inches narrower than nominal wythe thickness for all others.
   b. Ties perpendicular to wythe shall extend minimum half way into wythe thickness but shall maintain minimum 5/8-inch cover from exterior face of wall.

4. Custom fabricate reinforcement, ties and anchors for Project conditions. Custom fabricate horizontal reinforcing tees and intersection for other than 90-degree conditions.

2.7 JOINT FILLER

A. Compressible Filler: Closed cell neoprene sponge, ASTM D 1056 Class RE41, with 50 percent minimum compressibility in widths that permit sealant.

2.8 WEEP-HOLE MATERIAL

A. Product (Contractors Option):

1. Ultraviolet-resistant plastic cellular vent sized to fill a standard modular brick head joint, resistant to insects and free draining,

2. 90 percent open polyester mesh bonded with flame-retardant adhesive, sized to fill a standard modular brick head joint, resistant to insects and free draining, Mortar Net Weep Vents by Mortar Net USA, Ltd.

B. Color selected by Design Professional from manufacturer's standard colors.

2.9 AIR / VAPOR BARRIERS

A. As specified in Air / Vapor Barriers: Division 7.

2.10 FLASHING

A. As specified in Flashing and Sheet Metal: Division 7.

B. Shop fabricate sheet metal flashing including accessories, terminations and end dams.

2.11 JOINT SEALANTS

A. As specified in Joint Sealants: Division 7.

2.12 INSULATION

A. Insulation is specified in Building Insulation: Division 7. Insulation and adhesive shall be compatible with vapor barrier.

2.13 CLEANING SOLUTION

A. Contractor's Option:

1. Job mixed detergent solution of trisodium phosphate and laundry detergent [one-half (1/2) cup dry measure of each dissolved in 1 gallon of water.

2. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

2.14 MORTAR DROPPING CONTROL DEVICES

A. Contractor's option, of the following:

1. Mor-Control by Dur-O-Wal, Inc.

2. Mortar Net by Mortar Net USA, Ltd.

3. Mortar Maze by Advanced Building Products, Inc.

4. Total Flash by Mortar Net USA, Ltd. Contractor is responsible for coordinating with flashing specified in

5. Division 7.

Part 3 EXECUTION

3.1 EXAMINATION

A. Examine substrate conditions including, but not limited to, foundations, concrete work, cold-formed metal framing, sheathing, vapor barrier, flashing and insulation for compliance with requirements for installation tolerances and other conditions affecting performance of unit masonry.

B. For record, prepare written report listing conditions detrimental to performance of unit masonry.

C. Examine rough-in and built-in construction to verify actual locations of connections prior to installation.

D. Do not proceed until unsatisfactory conditions have been corrected.

E. Acceptance: Commencing Work constitutes acceptance of substrate. Future work or re-work required because of deficient substrates will be performed at no expense to the Owner.

3.2 PREPARATION

A. Ensure items built-in by Work of other Sections for this Work are properly located and sized.

B. Establish lines, levels, and coursing. Protect from disturbances.

C. Lay out walls in advance for accurate spacing of bond patterns with uniform joint widths and for accurate locating of openings, movement-type joints, returns, and offsets. Avoid the use of less-than-half-size units at corners, jambs, and where possible at other locations.

D. Broom clean concrete surfaces to support masonry. If surface is smooth finished roughen surface with a bush hammer to ensure masonry bond.

3.3 INSTALLATION: GENERAL

A. Comply with Referenced Standards, unless otherwise indicated.

B. Thickness: Build cavity and other masonry construction to full thickness indicated. Build single-wythe walls to actual thickness of masonry units, using units of nominal thickness indicated.

C. Build chases and recesses as indicated or required to accommodate items specified in this and other Sections. Provide minimum 8 inches {200 mm} of masonry between chase or recess and jamb or openings and between adjacent chases and recesses.

D. Leave openings for equipment to be installed before completion of masonry. After installation, complete masonry to match adjacent construction.

E. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining construction. Use full-size units without cutting where possible.

F. Protection: Protect masonry work from freezing and entry of water. Cover and secure top of each day's work with non- staining waterproof coverings.

G. Stopping and Resuming Work: In each course, rack back one-half (1/2) unit length for one-half (1/2) running bond or one-third (1/3) unit length for one-third (1/3) running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly, if required, and remove loose masonry units and mortar prior to laying fresh masonry.

H. Mortar Joints: Provide full bed and head mortar joints. Do not deeply furrow mortar beds. Head joints must be fully buttered with mortar and shoved tight against adjacent unit. Slushing head joints is not allowed. Units shall not be moved, tapped or realigned after initial placement. If a unit is displaced, all head and bed mortar must be removed, and procedure started over.

I. Building In: Construct unit masonry work to accommodate built-in Work. Build masonry into frames and against dissimilar Work. Slush frames full with mortar and build in anchorage furnished with dissimilar Work. For heavy items installed into masonry, provide a grout bed of 1:3 Portland cement sand mix and use wedges to relieve weight on grout. Rake joints 3/4 inch deep between exposed masonry and dissimilar Work to accommodate sealant. Build in Work furnished under other Specification Sections.

J. Tolerances:

1. Maximum Variation from Masonry Unit to Adjacent Masonry Unit: 1/16 inch.
2. Maximum Variation from Vertical and Horizontal Building Lines: 1/4 inch in 10 feet.
3. Maximum Variation from Cross-sectional Thickness of Cavity Walls: Plus or minus 1/4 inch.
4. Maintain flush face on exposed masonry surfaces.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than [**2 inches (50 mm)**] [**4 inches (100 mm)**]. Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

C. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

E. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

F. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.

G. Fill cores in hollow CMUs with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

H. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.
2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch (13-mm) clearance between end of anchor rod and end of tube. Space anchors [**48 inches (1200 mm)**] <**Insert spacing**> o.c. unless otherwise indicated.
3. Wedge nonload-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078443 "Joint Firestopping."

3.5 MORTAR BEDDING AND JOINTING

A. Lay CMU as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.

2. Bed webs in mortar in all courses of piers, columns, and pilasters.

3. Bed webs in mortar in grouted masonry, including starting course on footings.

4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.

   a. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.
   b. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

      1) Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.

      2) Allow cleaned surfaces to dry before setting.

      3) Wet joint surfaces thoroughly before applying mortar.

      4) Rake out mortar joints for pointing with sealant.

   c. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.6 CAVITY WALLS

A. Keep cavities clean of mortar droppings. Bevel mortar at cavity before laying masonry to minimize squeeze-out of mortar. Plaster squeeze-out mortar onto cavity face of masonry. Do not strike flush.

B. While veneer is being laid up protect cavity from mortar dripping with cavity board supported on ties. Move board up as work progresses. Do not leave cavity boards in finished cavity.

3.7 CAVITY INSULATION

A. Insulation is specified in Building Insulation: Division 7.

B. Attach insulation using small pads of adhesive spaced approximately 12 inches on center both ways on inside face or attach to inside face with plastic fasteners on ties designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as indicated.

C. Fill cracks and open gaps in insulation with semi-rigid insulation.

3.8 ANCHORING AND BRACING MASONRY

A. General: Provide ties, anchors, clips and other accessories to tie masonry together and to adjoining structure. Anchorage shall allow differential movement of connected materials while restraining applied loads.

   1. Anchorage to Cold-Formed Metal Framing: Attach wall ties to metal framing through sheathing and vapor barrier. Space anchors not more than 24 inches on center horizontally, and 16 inches on center vertically. Seal each fastener head with sealant approved in writing by vapor barrier manufacturer.

3.9 MOVEMENT JOINTS

A. Brick control joints: Install compressible filler 3/4 inch back from exposed face.

B. Provide control joints in brick masonry as indicated and at following points of weakness.

1. At a distance of not over one-half (1/2) allowable joint spacing from bonded intersections or corners.

2. At one (1) or both sides of door and window openings where indicated.

C. Install control joints in brick where indicated.

3.10 FLASHING AND WEEP HOLES

A. Comply with requirements of Flashing and Sheet Metal: Division 7.

B. Install embedded flashing and weep holes in masonry at copings, shelf angles, lintels, ledges, doors, windows and other obstructions to downward flow of water in wall, and where indicated. Flashing shall direct water to exterior of building.

C. Prepare masonry surfaces so that they are smooth and free from projections that could puncture flashing. Cover projecting bolts or other sharp objects with foam pads glued in place.

D. Seal penetrations in flashing with adhesive/sealant/tape as recommended in writing by flashing manufacturer before covering with mortar.

E. Thru-Wall Flashing:

1. Extend flashing as indicated and as follows: from hemmed drip at outer face, through outer wythe, turned up a minimum of 8 inches and into inner wythe 1 1/2 inches. Anchor top of flashing with termination bar and sealant.

2. Install thru-wall flashing continuous. Install continuous through control joints. At expansion joints, ends of non-continuous lintels and other interruptions of flashing, provide shop-fabricated end dams.

3. Joints between sheet metal portions of flashing shall be butt type with a loose back-up plate with four (4) rows of butyl coated foam tape and cover patch of membrane flashing.

F. At corners, intersections and terminations, install shop fabricated flashing pieces.

G. Install weep holes in head joints in exterior wythe immediately above embedded flashing at 24 inches on center in masonry veneer.

H. Install mortar dropping control devices per manufacturer's written instructions continuous above flashing.

3.11 REPAIR

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or if units or mortar does not match adjoining work. Install new units to match adjoining units and in fresh mortar or grout, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

3.12 CLEANING MASONRY

A. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry.

B. Remove large mortar particles by hand with wooden paddles and nonmetallic scrapers, hoes or chisels.

C. Test cleaning methods on Sample Panel; leave 1/2 of Sample Panel uncleaned for comparison purposes. Obtain Design Professional's approval of sample cleaning before proceeding with cleaning of masonry.

D. Comply with BIA "Technical Note No. 20 Revised".

3.13 PROTECTION OF FINISHED WORK

A. Protect Finished Work as per requirements of Division 1. Remove protection prior to Date of Substantial Completion.

B. Without damaging completed Work, provide protection boards at, for example, exposed external corners, lintels and soffits which may be damaged by construction activities.

.

END OF SECTION 042000

SECTION 044200 EXTERIOR STONE CLADDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Stone panels set with individual anchors.

1.3 ACTION SUBMITTALS

A. Product Data: For each variety of stone, stone accessory, and manufactured product.

B. Shop Drawings: Show fabrication and installation details for stone cladding assembly, including dimensions and profiles of stone units.

1. Show locations and details of joints both within stone cladding assembly and between stone cladding assembly and other construction.
2. Show locations and details of anchors.
3. Show direction of veining, grain, or other directional pattern.

C. Stone Samples for Verification: Sets for each variety, color, and finish of stone required; not less than 12 inches square.

1. Sets shall consist of at least three samples, exhibiting extremes of the full range of color and other visual characteristics expected and will establish the standard by which stone will be judged.

D. Colored Pointing Mortar Samples for Verification: For each color required. Make Samples using same sand and mortar ingredients to be used on Project.

E. Sealant Samples for Verification: For each type and color of joint sealant required.

F. Delegated-Design Submittal: For stone cladding assembly.

1.4 INFORMATIONAL SUBMITTALS

A. Material Test Reports:

1. Stone Test Reports: For stone variety proposed for use on Project, by a qualified testing agency, indicating compliance with required physical properties, other than abrasion resistance, according to referenced ASTM standards. Base reports on testing done within previous five years.

2. For metal components, by a qualified testing agency, indicating chemical and physical properties of metal.

3. Sealant Compatibility and Adhesion Test Report: From sealant manufacturer complying with requirements in Section 079200 "Joint Sealants" and indicating that sealants will not stain or damage stone. Include interpretation of test results and recommendations for primers and substrate preparation needed for adhesion.

B. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate stone cladding assemblies similar to that required for this Project and whose products have a record of successful in-service performance.

B. Installer Qualifications: A firm or individual experienced in installing stone cladding assemblies similar in material, design, and extent to that indicated for this Project, whose work has a record of successful in-service performance.

C. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

1.6 PRECONSTRUCTION TESTING

A. Preconstruction Sealant Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for compatibility and adhesion testing according to sealant manufacturer's standard testing methods and Section 079200 "Joint Sealants," Samples of materials that will contact or affect joint sealants.

B. Preconstruction Field Testing of Sealants: Before installing joint sealants, field test their adhesion to joint substrates according to Section 079200 "Joint Sealants."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store and handle stone and related materials to prevent deterioration or damage due to moisture, temperature changes, contaminants, corrosion, breaking, chipping, and other causes.

1. Lift stone with wide-belt slings; do not use wire rope or ropes that might cause staining. Move stone, if required, using dollies with cushioned wood supports.
2. Store stone on wood skids or pallets with nonstaining, waterproof covers. Arrange to distribute weight evenly and to prevent damage to stone. Ventilate under covers to prevent condensation.

B. Mark stone units, on surface that will be concealed after installation, with designations used on Shop Drawings to identify individual stone units. Orient markings on vertical panels so that they are right side up when units are installed.

C. Deliver sealants to Project site in original unopened containers labeled with manufacturer's name, product name and designation, color, expiration period, pot life, curing time, and mixing instructions for multicomponent materials.

D. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

E. Store aggregates in locations where grading and other required characteristics can be maintained and where contamination can be avoided.

1.8 FIELD CONDITIONS

A. Protect stone cladding during erection by doing the following:

1. Cover tops of stone cladding installation with nonstaining, waterproof sheeting at end of each day's work. Cover partially completed structures when work is not in progress. Extend cover a minimum of 24 inches down both sides and hold securely in place.
2. Prevent staining of stone from mortar, grout, sealants, and other sources. Immediately remove such materials without damaging stone.
3. Protect base of walls from rain-splashed mud and mortar splatter by coverings spread on ground and over wall surface.
4. Protect sills, ledges, and projections from mortar and sealant droppings.

B. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Remove and replace stone cladding damaged by frost or freezing conditions. Comply with cold-weather construction and protection requirements for masonry contained in TMS 602/ACI 530.1/ASCE 6.

C. Hot-Weather Requirements: Comply with hot-weather construction and protection requirements for masonry contained in TMS 602/ACI 530.1/ASCE 6.

D. Environmental Limitations for Sealants: Do not install sealants when ambient and substrate temperatures are outside limits permitted by sealant manufacturer or below 40 deg F or when joint substrates are wet.

1.9 COORDINATION

A. Coordinate installation of inserts that are to be embedded in concrete or masonry, flashing reglets, and similar items to be used by stone cladding Installer for anchoring, supporting, and flashing of stone cladding assembly. Furnish setting drawings, templates, and directions for installing such items and deliver to Project site in time for installation.

B. Time delivery and installation of stone cladding to avoid extended on-site storage and to coordinate with work adjacent to stone cladding.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Stone: Obtain stone from single quarry, resources to provide materials of consistent quality in appearance and physical properties.

1. For stone types that include same list of varieties and sources, provide same variety from same source for each.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of uniform quality for each cementitious component from single manufacturer and each aggregate from single source or producer.

C. Source Limitations for Other Materials: Obtain each type of stone accessory, sealant, and other material from single manufacturer for each product.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design stone cladding assembly.

B. General: Design stone anchors and anchoring systems according to ASTM C 1242.

1. Stone anchors shall withstand not less than two times the weight of the stone cladding in both compression and tension.

C. Structural Performance: Stone cladding assembly shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Wind Loads: As indicated.

D. Safety Factors for Stone: Design stone cladding assembly to withstand loads indicated without exceeding stone's allowable working stress determined by dividing stone's average ultimate strength, as established by testing, by the following safety factors:

1. Safety Factor for Granite: 3

E. Design stone anchors to withstand loads indicated without exceeding allowable working stresses established by the following:

1. For Cast-in-Place and Postinstalled Fasteners in Concrete: One-fourth of tested capacity when installed in concrete with compressive strength indicated.

F. Provisions for Fabrication and Erection Tolerances: Allow for fabrication and erection tolerances of building's structural system. Concrete fabrication and erection tolerances are specified in Section 033000 Cast-in-Place Concrete.

G. Corrosion and Staining Control: Prevent galvanic and other forms of corrosion as well as staining by isolating metals and other materials from direct contact with incompatible materials. Materials shall not stain exposed surfaces of stone and joint materials.

2.3 GRANITE

A. Material Standard: Comply with ASTM C 615/C 615M.

B. Cut stone from one block or contiguous, matched blocks in which natural markings occur.

C. Match Architect's samples for color, finish, and other stone characteristics relating to aesthetic effects.

2.4 ANCHORS AND FASTENERS

A. Fabricate anchors, including shelf angles, from stainless steel, ASTM A 240/A 240M or ASTM A 666, Type 304: temper as required to support loads imposed without exceeding allowable design stresses. Fabricate dowels and pins for anchors from stainless steel, ASTM A 276, Type 304.

B. Postinstalled Anchor Bolts for Concrete and Masonry: Chemical anchors, torque-controlled expansion anchors or undercut anchors made from stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Alloy Group A1 or A4) for bolts and nuts; ASTM A 240/A 240M, ASTM A 276, or ASTM A 666, Type 304 or 316, for anchors, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488/E 488M, conducted by a qualified independent testing agency.

C. Threaded Fasteners: Heavy hexagon structural bolts, heavy hexagon nuts, and hardened washers.

1. For stainless steel, use annealed stainless-steel bolts, nuts, and washers; for bolts, ASTM F 593 (ASTM F 738M); and for nuts, ASTM F 594 (ASTM F 836M), Alloy Group 1 (A1).

D. Weld Plates for Installation in Concrete: Comply with Section 055000 "Metal Fabrications."

2.5 MORTAR MATERIALS

A. Portland Cement: ASTM C 150/C 150M, Type I or Type II, except Type III may be used for cold-weather construction, natural color or white as required to produce mortar color indicated.

1. Low-Alkali Cement: Portland cement for use with limestone shall contain no more than 0.60 percent total alkali when tested according to ASTM C 114.

B. Hydrated Lime: ASTM C 207.

C. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979/C 979M. Pigments shall have a record of satisfactory performance in mortar.

D. Aggregate: ASTM C 144; except for joints narrower than 1/4 inch (6 mm) and pointing mortar, 100 percent shall pass No. 16 (1.18-mm) sieve.

1. Colored Aggregates: Natural-colored sand or ground marble, granite, or other durable stone; of color necessary to produce required mortar color.

E. Water: Potable.

2.6 STONE ACCESSORIES

A. Setting Shims: Strips of resilient plastic or vulcanized neoprene, Type A Shore durometer hardness of 50 to 70, nonstaining to stone, of thickness needed to prevent point loading of stone on anchors and of depths to suit anchors without intruding into required depths of pointing materials.

B. Concealed Sheet Metal Flashing: Fabricated from stainless steel in thicknesses indicated, but not less than 0.0156 inch (0.4 mm) thick, and complying with Section 076200 "Sheet Metal Flashing and Trim."

C. Weep and Vent Tubes: Rectangular, cellular, polypropylene or clear butyrate extrusion, 3/8 by 1-1/2 inches (9 by 38 mm), of length required to extend from exterior face of stone to cavity behind.

D. Sealants for Joints in Stone Cladding: Manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated below that comply with applicable requirements in Section 079200 "Joint Sealants" and do not stain stone.

2.7 STONE FABRICATION

A. General: Fabricate stone units in sizes and shapes required to comply with requirements indicated.

1. For granite, comply with recommendations in NBGQA's "Specifications for Architectural Granite."

B. Control depth of stone and back check to maintain minimum clearance of dimension indicated between backs of stone units and surfaces or projections of structural members, fireproofing (if any), backup walls, and other work behind stone.

C. Dress joints (bed and vertical) straight and at right angle to face unless otherwise indicated. Shape beds to fit supports.

D. Cut and drill sinkages and holes in stone for anchors, fasteners, supports, and lifting devices as indicated or needed to set stone securely in place.

E. Finish exposed faces and edges of stone to comply with requirements indicated for finish and to match approved samples.

F. Quirk-miter corners unless otherwise indicated; provide for cramp anchorage in top and bottom bed joints of corner pieces.

G. Cut stone to produce uniform joints 3/8 inch (10 mm) wide and in locations indicated.

H. Contiguous Work: Provide chases, reveals, reglets, openings, and similar features as required to accommodate contiguous work.

I. Fabricate molded work, including washes and drips, to produce stone shapes with a uniform profile throughout entire unit length, with precisely formed arris slightly eased to prevent snipping, and with matching profile at joints between units.

2.8 MORTAR MIXES

A. General: Comply with referenced standards and with manufacturers' written instructions. Do not use admixtures unless otherwise indicated.

B. Portland Cement-Lime Setting Mortar: Comply with ASTM C 270, Proportion Specification, Type S.

C. Pointing Mortar: Comply with ASTM C 270, Proportion Specification, Type S or Type N. Provide pointing mortar mixed to match Architect's sample and complying with the following:

1. Pigmented Pointing Mortar: Select and proportion pigments with other ingredients to produce color required. Do not exceed pigment-to-cement ratio of 1:10, by weight.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive stone cladding and conditions under which stone cladding will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of stone cladding.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SETTING STONE CLADDING, GENERAL

A. Execute stone cladding installation by skilled mechanics and employ skilled stone fitters at Project site to do necessary field cutting as stone is set.

1. Use power saws with diamond blades to cut stone. Produce lines cut straight and true, with edges eased slightly to prevent snipping.

B. Set stone to comply with requirements indicated. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure stone cladding in place. Shim and adjust anchors, supports, and accessories to set stone accurately in locations indicated, with uniform joints of widths indicated, and with edges and faces aligned according to established relationships and indicated tolerances.

C. Provide expansion, control, and pressure-relieving joints of widths and at locations indicated.

1. Sealing expansion and other joints is specified in Section 079200 "Joint Sealants."

2. Keep expansion joints free of mortar and other rigid materials.

D. Install concealed flashing at continuous shelf angles, lintels, ledges, and similar obstructions to downward flow of water, to divert water to building exterior. Extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.

E. Keep cavities open where unfilled space is indicated between back of stone units and backup wall; do not fill cavities with mortar or grout.

1. Place weep holes in joints where moisture may accumulate, including at base of cavity walls and above shelf angles and flashing. Locate weep holes at intervals not exceeding 24 inches (600 mm).
2. Place vents in cavity walls at tops of cavities, below shelf angles and flashing, and at intervals not exceeding 20 feet (6 m) vertically. Locate vents in joints at intervals not exceeding 60 inches (1500 mm) horizontally.

3.3 SETTING MECHANICALLY ANCHORED STONE CLADDING

A. Attach anchors securely to stone and to backup surfaces. Comply with recommendations in ASTM C 1242.

B. Provide compressible filler in ends of dowel holes and bottoms of kerfs to prevent end bearing of dowels and anchor tabs on stone. Fill remainder of anchor holes and kerfs with sealant indicated for filling kerfs.

C. Set stone supported on clips or continuous angles on resilient setting shims. Use material of thickness required to maintain uniform joint widths and to prevent point loading of stone on anchors. Hold shims back from face of stone a distance at least equal to width of joint.

3.4 JOINT-SEALANT INSTALLATION

A. Prepare joints and apply sealants of type and at locations indicated to comply with applicable requirements in Section 079200 "Joint Sealants."

3.5 INSTALLATION TOLERANCES

A. Variation from Plumb: For vertical lines and surfaces of walls, do not exceed 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (10 mm in 6 m), or 1/2 inch in 40 feet (12 mm in 12 m) or more. For external corners, corners and jambs within 20 feet (6 m) of an entrance, expansion joints, and other conspicuous lines, do not exceed 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 3/8 inch in 40 feet (10 mm in 12 m) or more.

B. Variation from Level: For lintels, sills, water tables, parapets, horizontal bands, horizontal grooves, and other conspicuous lines, do not exceed 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 3/8 inch (10 mm) maximum.

C. Variation of Linear Building Line: For positions shown in plan and related portions of walls and partitions, do not exceed 1/4 inch in 20 feet (6 mm in 6 m) or 1/2 inch in 40 feet (12 mm in 12 m) or more.

D. Variation in Cross-Sectional Dimensions: For thickness of walls from dimensions indicated, do not exceed plus or minus 1/4 inch (6 mm).

E. Variation in Joint Width: Do not vary from average joint width more than plus or minus 1/8 inch (3 mm) or a quarter of nominal joint width, whichever is less. For joints within 60 inches (1500 mm) of each other, do not vary more than 1/8 inch (3 mm) or a quarter of nominal joint width, whichever is less from one to the other.

F. Variation in Plane between Adjacent Stone Units (Lipping): Do not exceed 1/16-inch (1.5-mm) difference between planes of adjacent units.

3.6 ADJUSTING AND CLEANING

A. Remove and replace broken, chipped, stained, or otherwise damaged stone, defective joints, and stone cladding that does not match approved samples. Damaged stone may be repaired if Architect approves methods and results.

B. Replace damaged or defective work in a manner that results in stone cladding's matching approved samples complying with other requirements, and showing no evidence of replacement.

C. Final Cleaning: Clean stone cladding no fewer than six days after completion of pointing and sealing, using clean water and stiff-bristle fiber brushes. Do not use wire brushes, acid-type cleaning agents, cleaning agents containing caustic compounds or abrasives, or other materials or methods that could damage stone.

END OF SECTION 044200

SECTION 050300 FLUOROPOLYMER COATINGS

Part 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Applicable Sections: Division 1.

C. Metal Panel System: Division 7.

D. Flashing and Sheet Metal: Division 7.

E. Aluminum Entrances and Storefronts: Division 8.

F. Aluminum Curtainwall: Division 8.

G. Decorative Formed Metal: Division 5.

1.2 SUMMARY (NON-INCLUSIVE)

A. Section Includes: Fluoropolymer coatings applied to metal substrates specified in other Sections.

1.3 SUBMITTALS

A. Submit per the requirements of Division 1.

B. Product Data: Manufacturer's pre-printed literature for products and their application.

C. Samples:

1. Duplicate sets, finish Samples on each substrate to which coatings are to be applied in Final Work. Minimum of three (3) Samples in each set of each finish demonstrating maximum range of variation in finish.

Sheet or Plate: 8 1/2 inches by 11 inches punched for three-ring binder.
Extruded, Rolled or Formed Shapes: 12-inch-long section of actual section.

D. Qualifications:

1. Manufacturer's Qualifications: Written evidence of compliance.

2. Applicator's Qualifications: Written evidence of compliance.

E. Quality Control Procedures: Applicator's reports of tests performed in accordance with Source Quality Control Article of this Section.

F. Certifications: Manufacturer's certification of approval of applicator.

G. Closeout Submittals: Special written warranty on fluoropolymer coatings.

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1.4 DEFINITIONS

A. Fluoropolymer Coating: High performance organic coating.

B. Manufacturer: As used in this Section means manufacturer of coating.

1.5 SYSTEM DESCRIPTION

A. Performance Requirements: Conform to indicated criteria for the following tests:

1. American Architectural Manufacturers Association (AAMA) Standard 2605, "Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels".

2. Specular Gloss: Gloss values shall be within plus or minus five (5) units of manufacturer's specification. Measure in accordance with ASTM D 523 using a 60-degree gloss meter. Samples shall include minimum dry film thickness.

3. Dry Film Hardness: No rupture of film using a Berol Eagle Turquoise pencil, grade F minimum hardness, test in accordance with ASTM D 3363.

4. Film Adhesion: No removal of film under tape within or outside of cross-hatched area or blistering anywhere on wet test specimen, test in accordance with AAMA 2605.

5. Impact Resistance: No removal of film to substrate, test in accordance with AAMA 2605.

6. Abrasion Resistance: Abrasion Coefficient Value of 20 minutes, test in accordance with ASTM D 968.

7. Salt Spray Resistance: Minimum blister rating of 8, in accordance with ASTM D 1654, after 3,000 hours, test in accordance with ASTM B 117.

8. Humidity Resistance: Formation of blisters not to exceed "Few" blisters Size No. 8, as shown in Figure 4, ASTM D 714, after 3,000 hours, test in accordance with ASTM D 2247.

9. Condensing Humidity Resistance: No blisters, undercutting, or adhesion loss after 1,000 hours, test in accordance with ASTM D 4585.

10. Chemical Resistance: Test in accordance with AAMA 2605:

    Muriatic Acid Resistance: No blistering, and no visual change in appearance when examined by the unaided eye.
    Mortar Resistance: Mortar shall dislodge easily from painted surface, and any residue shall be removable with a damp cloth. Lime residue with 10 percent muriatic solution. There shall be no loss of film adhesion or visual change in appearance when examined by unaided eye.
    Nitric Acid Resistance: Not more than five (5) delta E Units (Hunter) of color change, calculated in accordance with ASTM D 2244, when comparing measurements on acid-exposed painted surface and unexposed surface.
    Detergent Resistance: No loss of adhesion on film to metal. No blistering and no significant visual change in appearance when examined by unaided eye.

11. Acid Pollutants Resistance: Not more than five (5) Delta E Units (Hunter) of color change, calculated in accordance with ASTM D 2244, when comparing measurements on acid-exposed painted surface and unexposed surface.

12. Weathering: Test in accordance with AAMA 2605:

    Color Retention: Maximum of five (5) Delta E Units (Hunter) of color change as calculated in accordance with ASTM D 2244.
    Chalk Resistance: Chalking shall be no more than that represented by a No. 8 rating based on ASTM D 659 after test site exposure.
    Gloss Retention: Not less than 30 percent after exposure test.
    Resistance to Erosion: Less than 10 percent film loss after exposure test.

1.6 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Company licensed to produce fluoropolymer coatings based on Kynar 500 polyvinylidene fluoride (PVF2) resin manufactured by Atochem North America or Hylar 5000 polyvinylidene fluoride (PVF2) resin manufactured by Ausimont USA, Inc.

B. Applicator's Qualifications: Company authorized and approved in writing by fluoropolymer coating manufacturer to apply their product.

C. Single Source Requirements: All products required for fluoropolymer coatings specified in this Section shall be supplied by one (1) manufacturer, regardless of substrate, manufacturer of substrate or Section in which substrate is specified.

1. Coordinate approved coating manufacturer with manufacturers of substrates to which coatings are to be applied.

2. More than one (1) applicator may be used contingent on each applicator complying with indicated requirements and that coatings match approved Samples.

3. Differences in coatings caused by use of more than one (1) applicator shall not relieve Contractor of requirements to match approved Samples. Differences in coatings are not acceptable.

1.7 SPECIAL WARRANTY

A. Warrant fluoropolymer coatings against defects in appearance and performance of materials and workmanship. Warrant coil coatings for a minimum of ten (10) years and spray applied coatings for a minimum of seven (7) years from Date of Substantial Completion of Work to which coatings are applied.

B. Defects include, but not limited to:

1. Failure to conform to appearance and performance requirements set forth in AAMA 2605, and the Physical Test Requirements of NCCA, as applicable to each system.

2. Cracking, chipping, fading, peeling, blistering, running or other deterioration or non-uniformity of color or finish.

Part 2 PRODUCTS

2.1 APPROVED MANUFACTURER

A. Products of indicated manufacturers are acceptable, subject to compliance indicated requirements. Equivalent products of other manufacturers will be evaluated as substitutions in accordance with requirements of Division 1.

1. PPG Industries, Inc.

2. Valspar.

3. Akzo Nobel Coatings, Inc.

4. BASF Corporation.

2.2 MATERIALS

A. Fluoropolymer Coating: Air drying, thermo-curing, high performance organic coating, formulated under license, containing not less than 70 percent fluoropolymer Kynar 500 or Hylar 5000 resin by weight.

B. Corrosion Inhibitive Primer: As recommended in writing by coating manufacturer for systems specified.

2.3 COLOR MATCHING

A. Colors of fluoropolymer coatings throughout Work shall match the following: Provide variations of color formulation if required to consistently match color across differing base materials and by differing application methods.

1. Finish 1 (FC-1): PPG UC125046F Duranar Sunstorm Bronze (Two Coat system) produced by PPG Industries, Inc.

   Curtainwall Mullions.
   Curtainwall caps where indicated on drawings.
   Copings where indicated on drawings.
   Perforated metal panels in curtainwall system
   Interior and Exterior Metal Fabrications where indicated on drawings

2. Finish 2 (FC-2): PPG UC105738 Duranar MALT (Two Coat system) produced by PPG Industries, Inc.

   Exterior Metal Panel
   Copings where indicated on drawings.

B. Manufacturer of coating to be matched shall promptly provide required information to other manufacturers of coatings for this Work, upon request by those other manufacturers.

2.4 FABRICATION: GENERAL

A. Metal Preparation, Pretreatment, and Application of Coating: In accordance with manufacturer's written instructions and as required to conform with indicated criteria.

B. Coil Coated Systems:

1. Two Coat System:

   Corrosion inhibitive primer applied at 0.80 mil dry film thickness.
   Color topcoat applied at minimum 0.80 mil dry film thickness.
   Total coating system minimum dry film thickness of 1.60 mils .

2. Three Coat System:

   Corrosion inhibitive primer applied at 0.20 mil dry film thickness.
   Metallic Color coat applied at 0.75 mil dry film thickness.
   Clear topcoat applied at 0.50 mil dry film thickness.
   Total coating system minimum dry film thickness of 1.40 mils .

C. Spray Applied Systems:

1. Two Coat System:

   Corrosion inhibitive primer applied at 0.20 mil dry film thickness.
   Color topcoat applied at 1.0 mil dry film thickness.
   Total coating system minimum dry film thickness of 1.20 mils .

2. Three Coat System:

   Corrosion inhibitive primer applied at 0.25 mil dry film thickness.
   Metallic Color coat applied at 1.0 mil dry film thickness.
   Clear topcoat applied at 0.50 mil dry film thickness.
   Total coating system minimum dry film thickness of 1.70 mils .

2.5 SOURCE QUALITY CONTROL

A. Tests: Perform the following tests on production run Samples with a test area not less than 3 inches by 12 inches. Use test procedures and test criteria specified under Performance Requirements. Test not less than once during each production hour.

1. Specular Gloss.
2. Film Adhesion.

Part 3 EXECUTION

3.1 ADJUSTING

A. Touch-Up: Repair scratches with air-dry fluoropolymer coating material in accordance with manufacturer's written instructions. Repaired scratches shall be undetectable with unaided eye at a distance of 10 feet.

END OF SECTION 050300

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Structural steel.
2. Shrinkage-resistant grout.

B. Related Requirements:
1. Section 055000 "Metal Fabrications" for miscellaneous steel fabrications and other steel items not defined as structural steel.
2. Section 099600 "High Performance Coating" for painting requirements.

1.3 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC303.

1.4 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.5 ACTION SUBMITTALS

A. Product Data:
1. Structural-steel materials.
2. High-strength, bolt-nut-washer assemblies.

3. Anchor rods.
4. Threaded rods.
5. Shop primer.
6. Galvanized-steel primer.
7. Galvanized repair paint.
8. Shrinkage-resistant grout.

B. Shop Drawings: Show fabrication of structural-steel components.
1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment Drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.

C. Delegated-Design Submittal: For structural-steel connections indicated on Drawings to comply with design loads, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and fabricator

B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

C. Mill test reports for structural-steel materials, including chemical and physical properties.

D. Refer to section 099600 ”High Performance Coating” for finish paint color sample submittal requirements.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).

B. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category ACSE.

C. Shop-Painting Applicators: Qualified in accordance with SSPC-QP 3.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F3125/F3125M, Grade F1852 bolt assemblies and for retesting bolt assemblies after lubrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with applicable provisions of the following specifications and documents:

1. ANSI/AISC 303.
2. ANSI/AISC 360.
3. RCSC's "Specification for Structural Joints Using High-Strength Bolts."

B. Connection Design Information:

1. Design connections and final configuration of member reinforcement at connections in accordance with ANSI/AISC 303 by fabricator's qualified professional engineer.

a. Use Load and Resistance Factor Design; data are given at factored-load level or Allowable Stress Design; data are given at service-load level.

2.2 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A992/A992M

B. Channels, Angles: ASTM A36/A36M.

C. Plate and Bar: ASTM A36/A36M.

D. Cold-Formed Hollow Structural Sections: ASTM A500/A500M, Grade B structural tubing.

E. Steel Pipe: ASTM A53/A53M, Type E or Type S, Grade B.

F. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS AND CONNECTORS

A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, GradeA325 (Grade A325M), Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH (ASTM A563M, Class 10S), heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.

2.4 RODS

A. Headed Anchor Rods: ASTM F1554, Grade 36, straight.
   1. Nuts: ASTM A563 (ASTM A563M) heavy hex carbon steel.
   2. Plate Washers: ASTM A36/A36M carbon steel.
   3. Washers: ASTM F436 (ASTM F436M), Type 1, hardened carbon steel.
   4. Finish: Plain.

2.5 PRIMER

A. Steel Primer:
   1. Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

2.6 PAINT:

A. Shop Paint topcoat:
   1. All steel exposed in finished construction to be shop painted. Comply with Section 099600 “High Performance Coating.”

2.7 SHRINKAGE-RESISTANT GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.8 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.

1. Camber structural-steel members where indicated.
2. Fabricate beams with rolling camber up.
3. Identify high-strength structural steel in accordance with ASTM A6/A6M and maintain markings until structural-steel framing has been erected.
4. Mark and match-mark materials for field assembly.
5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted in accordance with SSPC-SP 2

F. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
1. Cut, drill, or punch holes perpendicular to steel surfaces
2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.9 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1Mfor tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.10 SHOP PRIMING

A. Shop prime steel surfaces, except the following:
1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).

2. Surfaces to be field welded.
3. Surfaces of high-strength bolted, slip-critical connections.
4. Surfaces enclosed in interior construction.

B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:

1. SSPC-SP 1 and as specified in Section 099123 " Painting".

C. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

D. Painting: After shop priming, apply finish paint in accordance with manufacturer's written instructions and in accordance with Section 099600 "High Performance Coating". Use painting methods that result in full coverage of joints, corners, edges and exposed surfaces.
1. All structural steel that is shop primed and painted shall be protected during delivery and installation. All damage to finish coat shall be touched up in the field.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated on Drawings.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.

B. Baseplates, Bearing Plates and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
3. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for grouting.

C. Maintain erection tolerances of structural steel within ANSI/AISC 303.

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure. Slope roof framing members to slopes indicated on Drawings.

E. Splice members only where indicated.

F. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.

3.5 REPAIR

A. Touchup Painting:

1. Cleaning and touchup painting are specified in Section 099123 "Interior Painting" and 099600 "High Performance Coating".

3.6 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:

1. Verify structural-steel materials and inspect steel frame joint details.
2. Verify weld materials and inspect welds.
3. Verify connection materials and inspect high-strength bolted connections.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

END OF SECTION 051200

SECTION 051213 - ARCHITECTURALLY EXPOSED STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes architecturally exposed structural-steel (AESS).

1. Requirements in Section 051200 "Structural Steel Framing" also apply to AESS.

B. Related Requirements:

1. Section 051200 "Structural Steel Framing" for additional requirements applicable to AESS.
2. Section 055000 "Metal Fabrications"
3. Section 099600 "High-Performance Coatings".

1.3 DEFINITIONS

A. AESS: Structural steel designated as "architecturally exposed structural steel" or "AESS" in the Contract Documents.

B. Category 1 AESS: AESS that is within 96 inches vertically and 36 inches horizontally of a walking surface and that is visible to a person standing on that walking surface or is designated as "Category 1 architecturally exposed structural steel" or "AESS-1" in the Contract Documents.

C. Category 2 AESS: AESS that is within 20 feet vertically and horizontally of a walking surface and that is visible to a person standing on that walking surface or is designated as "Category 2 architecturally exposed structural steel" or "AESS-2" in the Contract Documents.

D. Category 3 AESS: AESS that is not defined as Category 1 or Category 2 or that is designated as "Category 3 architecturally exposed structural steel" or "AESS-3" in the Contract Documents.

1.4 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

1.5 ACTION SUBMITTALS

A. Shop Drawings: Show fabrication of AESS components. Shop Drawings for structural steel may be used for AESS provided items of AESS are specifically identified and requirements below are met for AESS.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment Drawings.

3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain. Indicate grinding, finish, and profile of welds.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
5. Indicate exposed surfaces and edges and surface preparation being used.
6. Indicate special tolerances and erection requirements.

B. Samples:
1. Refer to section 099600 "High Performance Coating" for finish paint color sample submittal requirements.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and Fabricator.

B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.7 QUALITY ASSURANCE

A. Shop-Painting Applicators: Qualified according to SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."

B. Mockups: Build mockups of AESS to set quality standards for fabrication and installation.

1. Build mockup of typical portion of AESS as shown on Drawings.
2. Coordinate painting requirements with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
3. Coordinate high-performance coatings requirements with Section 099600 "High-Performance Coatings."
4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Use special care in handling to prevent twisting, warping, nicking, and other damage. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.9 FIELD CONDITIONS

A. Field Measurements: Where AESS is indicated to fit against other construction, verify actual dimensions by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 BOLTS, CONNECTORS, AND ANCHORS

A. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, round-head assemblies, consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.

1. Finish: Plain.

2.2 PRIMER

A. Primer: Comply with 099123 " Painting," and Section 099600 "High-Performance Coatings**."**

B. Primer: SSPC-Paint 25, **Type II**, zinc oxide, alkyd, linseed oil primer.

C. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

D. Etching Cleaner for Galvanized Metal: MPI#25.

E. Galvanizing Repair Paint: ASTM A 780/A 780M.

F. Shop Primer for Galvanized Steel: MPI#134, water-based galvanized metal primer.

2.3 FABRICATION

A. Shop fabricate and assemble AESS to the maximum extent possible. Locate field joints at concealed locations if possible. Detail assemblies to minimize handling and to expedite erection.

B. In addition to special care used to handle and fabricate AESS, comply with the following:

1. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, and roughness.
2. Grind sheared, punched, and flame-cut edges of Category 3 AESS to remove burrs and provide smooth surfaces and edges.
3. Fabricate Category 3 AESS with exposed surfaces free of mill marks, including rolled trade names and stamped or raised identification.
4. Fabricate Category 3 AESS with exposed surfaces free of seams to maximum extent possible.
5. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.
6. Fabricate with piece marks fully hidden in the completed structure or made with media that permits full removal after erection.
7. Fabricate Category 3 AESS to the tolerances specified in AISC 303 for steel that is designated AESS.
8. Fabricate Category 3 AESS to the tolerances specified in AISC 303 for steel that is not designated AESS.
9. Seal-weld open ends of hollow structural sections with 3/8-inch closure plates for Category 3 AESS.

C. Coping, Blocking, and Joint Gaps: Maintain uniform gaps of 1/8 inch with a tolerance of 1/32 inch for Category 3 AESS.

D. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

E. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.

1. Cut, drill, or punch holes perpendicular to steel surfaces.
2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.4 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work, and comply with the following:

1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding specified tolerances.
2. Use weld sizes, fabrication sequence, and equipment for AESS that limit distortions to allowable tolerances.
3. Provide continuous, sealed welds at angle to gusset-plate connections and similar locations where Category 3 AESS is exposed to weather.
4. Provide continuous welds of uniform size and profile where Category 3 AESS is welded.
5. At locations where welding on the far side of an exposed connection of Category 1 and Category 2 AESS occurs, grind distortions and marking of the steel to a smooth profile aligned with adjacent material.
6. Make fillet welds for Category 3 AESS oversize and grind to uniform profile with smooth face and transition.
7. Make fillet welds for Category 3 AESS of uniform size and profile with exposed face smooth and slightly concave. Do not grind unless directed to correct unacceptable work.

2.5 SHOP PRIMING AND PAINTING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
2. Surfaces to be field welded.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
1. SSPC-SP 3, "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

D. Painting: After shop priming, apply finish paint in accordance with manufacturer's written instructions and in accordance with Section 099600 "High Performance Coating". Use painting methods that result in full coverage of joints, corners, edges and exposed surfaces.
1. All structural steel that is shop primed and painted shall be protected during delivery and installation. All damage to finish coat shall be touched up in the field.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Examine AESS for twists, kinks, warping, gouges, and other imperfections before erecting.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep AESS secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

1. If possible, locate welded tabs for attaching temporary bracing and safety cabling where they will be concealed from view in the completed Work.

3.3 ERECTION

A. Set AESS accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

1. Erect Category 3 AESS to the tolerances specified in AISC 303 for steel that is designated AESS.
2. Erect Category 3 AESS to the tolerances specified in AISC 303 for steel that is not designated AESS.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.
2. Orient bolt heads as indicated on Drawings.

B. Weld Connections: Comply with requirements in "Weld Connections" Paragraph in "Shop Connections" Article.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect AESS as specified in Section 051200 "Structural Steel Framing." The testing agency is not responsible for enforcing requirements relating to aesthetic effect.

B. Architect will observe AESS in place to determine acceptability relating to aesthetic effect.

3.6 REPAIRS AND PROTECTION

A. Remove welded tabs that were used for attaching temporary bracing and safety cabling and that are exposed to view in the completed Work. Grind steel smooth.

B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

END OF SECTION 051213

SECTION 052100 - STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. K-series steel joists.
2. Steel joist accessories.

1.3 DEFINITIONS

A. SJI's "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."

1.4 ACTION SUBMITTALS

A. Product Data: For each type of joist, accessory, and product.

B. Shop Drawings:

1. Include layout, designation, number, type, location, and spacing of joists.
2. Include joining and anchorage details; bracing, bridging, and joist accessories; splice and connection locations and details; and attachments to other construction.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Manufacturer certificates.

C. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer responsible for its preparation.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications
   1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.

B. Welding Qualifications: Qualify field-welding procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle joists as recommended in SJI's "Specifications

B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated on Drawings.
   1. Design special joists to withstand design loads with live-load deflections no greater than the following:
      a. Roof Joists: Vertical deflection of 1/240 of the span.

2.2 STEEL JOISTS

A. K-Series Steel Joist: Manufactured steel joists of type indicated according to "Standard Specification for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.

   1. Joist Type: K-series steel joists and KCS-type K-series steel joists.
   2. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated on Drawings, complying with SJI's "Specifications."
   3. Camber joists according to SJI's "Specifications."

2.3 PRIMERS

A. Primer:

1. SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.
2. Provide shop primer that complies with Section 099600 "High-Performance Coatings." (coordinate extents with architect)

2.4 STEEL JOIST ACCESSORIES

A. Bridging:

1. Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.

B. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325 (Grade A325M), Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, (ASTM A563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.
1. Finish: Plain.

C. Welding Electrodes: Comply with AWS standards.

D. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

2.5 CLEANING AND SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2.

B. Do not prime paint joists and accessories to receive sprayed fire-resistive materials.

C. Apply one coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil thick.

D. Shop priming of joists and joist accessories is specified in Section 099600 "High-Performance Coatings."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Do not install joists until supporting construction is in place and secured.

B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications joist manufacturer's written instructions, and requirements in this Section.
   1. Before installation, splice joists delivered to Project site in more than one piece.
   2. Space, adjust, and align joists accurately in location before permanently fastening.
   3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
   4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads are applied.

C. Field weld joists to supporting steel. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

D. Bolt joists to supporting steel framework using carbon-steel bolts.

E. Bolt joists to supporting steel framework using high-strength structural bolts. Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for high-strength structural bolt installation and tightening requirements.

F. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.3 REPAIRS

A. Touchup Painting:

   1. Immediately after installation, clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, abutting structural steel, and accessories.

      a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
      b. Apply a compatible primer of same type as primer used on adjacent surfaces.

   2. Cleaning and touchup painting are specified in Section 099600 "High-Performance Coatings."

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

END OF SECTION 052100

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Roof deck.

B. Related Requirements:
   1. Section 055000 "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.
   2. Section 099123 "Interior Painting" for repair painting of primed deck and finish painting of deck.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Roof deck.

B. Shop Drawings:
   1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.4 QUALITY ASSURANCE

A. FM Approvals' RoofNav Listing: Provide steel roof deck evaluated by FM Approvals and listed in its RoofNav for Class 1 fire rating and Class 1-90 windstorm ratings. Identify materials with FM Approvals Certification markings.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

2.2 ROOF DECK

A. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No.31, and with the following:
   1. Galvanized and Shop-Primed Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 80, G60 zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.
      a. Color: White.
   2. Profile Depth: As indicated .
   3. Design Uncoated-Steel Thickness: As indicated.
   4. Span Condition: Triple span or more.
   5. Side Laps: Overlapped

2.3 ACCESSORIES

A. Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

G. Galvanizing Repair Paint: ASTMA780/A780M.

H. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 INSTALLATION OF ROOF DECK

A. Fasten roof-deck panels to steel supporting members as indicated on drawings.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports as indicated on drawings

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:

1. End Joints: Lapped 2 inches (51 mm) minimum.

D. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.
1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

E. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 REPAIR

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

B. Repair Painting:
1. Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Section 099123 "Interior Painting."

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

END OF SECTION 053100

SECTION 054000 COLD-FORMED METAL FRAMING (CFMF)

PART 1 GENERAL

1.1 SUMMARY (NON-INCLUSIVE)

A. Section Includes:

1. Non-load bearing exterior framing.
2. Miscellaneous cold-formed metal framing.

1.2 RELATED WORK SPECIFIED ELSEWHERE (NON-INCLUSIVE)

A. Applicable Sections: Division 1.

B. Sheathing: Division 6.

C. Exterior Enclosure, General: Division 7.

D. Building Insulation: Division 7.

E. Gypsum Wallboard Assemblies: Division 9, refer to for interior lightweight metal-stud framing and ceiling-suspension systems.

F. Gypsum Shaftwall Assemblies: Division 9, refer to for interior lightweight metal stud framing and ceiling suspension systems.

1.3 SUBMITTALS

A. Submit per the requirements of Division 1.

B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining Work. Indicate extent of shop fabrication versus field work.

1. Plans and Elevations: Minimum 1/8-inch equals 1 foot scale.
2. Details: Minimum 1/2-inch equals 1 foot scale.

C. Product Data: Indicating compliance with requirements for each type of cold-formed metal framing product, anchor, fastener, clip and accessory.

1. Fire Ratings: Documentation of compliance with requirements for fire ratings.

D. Calculations: Signed and sealed calculations by a Professional Engineer licensed in State of New Jersey, documenting conformance with indicated loading and performance criteria.

E. Qualifications: Proof of compliance with indicated qualifications.

F. Quality Control Procedures:

1. Mill Certificates: Test reports from a qualified independent Testing Agency indicating steel sheet complies with requirements.
2. Reports indicating compliance with indicated criteria for welding qualifications and procedures.

G. Certifications: Letters from manufacturer or installer of metal panels, louvers, windows, and curtainwall certifying cold formed steel is coordinated with and adequate to support their systems.

1.4 DEFINITIONS

A. Minimum Uncoated Steel Thickness: Minimum 95 percent of thickness used in cold-formed framing design. Lesser thicknesses shall be permitted at bends due to cold forming.

B. Producer: Entity that produces steel sheet coil fabricated into cold-formed members.

C. Load-Bearing: Framing supporting gravity loads of construction plus other indicated design gravity and lateral loads.

D. Non-load Bearing: Framing supporting indicated lateral design loads, but not supporting gravity loads other than gravity load of framing itself and elements attached to framing.

1.5 SYSTEM REQUIREMENTS

A. Design: Design and engineer system in compliance with indicated design intent and criteria.

1. Maintain basic dimensions of system, sight lines, jointing, and profiles. Minor variation is allowable only with approval of Design Professional and if variations are identified on submittals.

2. Design and engineer components of system within a reasonable inference of indicated design intent.

B. Structural Requirements: Design and size components to withstand loading and deflection criteria in accordance with Exterior Enclosure, General: Division 7, and as indicated on structural drawings.

1. Loading:

   a. System Dead Loads: As indicated on structural drawings.
   b. Superimposed Dead Loads: Superimposed dead loads shall be based on construction as indicated.
   c. Wind Loads: As indicated on structural drawings.
   d. Seismic Loads: As indicated on structural drawings.
   e. Thermal Loads: Loads resulting from restraint of thermal movement shall be based on thermal design differentials indicated.

2. Deflection Limits:

   a. Design framing systems to withstand lateral design loads with deflections no greater than 1/600 of wall height for wall construction with masonry veneer, 1/360 of wall height elsewhere.
   b. Vertical deflection of the system shall be controlled within detailing requirements and as indicated.

C. Movement: Design system to accommodate movement criteria in accordance with Exterior Enclosure, General: Division 7.

1. Design framing systems to allow for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 degrees F.

2. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate movement of primary building structure as follows:

   a. Upward and downward deflection of 1/2 inch.
   b. Lateral racking of 1/2 inch per floor.

D. Design framing without regard for bracing contribution of sheathing materials.

1.6 QUALITY ASSURANCE

A. Manufacturer's Qualifications:

1. Experience: Minimum five (5) years producing products similar to those required for this Project, including products for three (3) projects of scope, schedule and complexity similar to this Project within last two (2) years as acceptable by Contractor and Owner's Representative.

2. Manufacturer's Designer: Professional Engineer licensed in the State of New Jersey, educated and specializing in structural engineering, and with minimum five (5) years experience designing systems similar to those required for this Project.

3. Single Source Requirements: Products shall be supplied by one (1) manufacturer. Accessory products including, for example, fasteners, sealants and anchors may be from other than primary manufacturer if approved in writing by primary manufacturer.

4. Certify compliance. Include Project descriptions with Owner and Contractor contacts for previous experience and resume for designer.

B. Installer's Qualifications:

1. Experience: Minimum five (5) years installing products similar to those required for this Project, including three (3) projects of scope, schedule and complexity similar to this Project within last two (2) years as acceptable to Contractor.

2. Certify compliance. Include Project descriptions with Owner and Contractor contacts for previous experience.

C. Welder's Qualifications:

1. Welding Procedures and Qualifications: In accordance with "Structural Welding Code, Steel", AWS D1.1 and AWS D1.3.

2. Welders shall be qualified to perform type of Work required.

3. Identification: Each welder shall be assigned an identification symbol and shall mark his identification at each shop and field weld.

D. Mill certificates signed by steel sheet producer test reports from a qualified independent Testing Agency indicating steel sheet complies with requirements, including uncoated steel thickness, yield strength, tensile strength, total elongation, chemical requirements, ductility, and galvanized-coating thickness.

E. Regulatory Requirements: Comply with the following in accordance with Division 1.

1. Fire-resistance Ratings: Where metal framing is part of a fire-resistance rated assembly, provide framing identical to that of assemblies tested for fire-resistance per the following:

f. ASTM E 119, by GA File Numbers in GA-600, "Fire-Resistance Design Manual".
g. UL's "Fire-Resistance Directory".
h. As otherwise acceptable to Authorities Having Jurisdiction.

F. Referenced Codes and Standards: Comply with the following in accordance with Division 1.

1. AISI "North American Specification for the Design of Cold-Formed Steel Structural Members", for Calculating Structural Characteristics of Cold-Formed Metal Framing

2. CCFSS Technical Bulletin: "AISI Specification Provisions for Screw Connections"

G. Field Samples:

1. Approval: Obtain Design Professionals approval before commencing remainder of Work.

2. Location: At location as agreed with Owner.

3. Extent: One bay wide, and at minimum one floor high.

4. Disposition: Approved Field Sample may be incorporated into finished Work.

H. Preinstallation Meeting: Refer to Exterior Enclosure, General: Division 7.

I. Preconstruction Meetings: Approximately two (2) weeks before scheduled commencement of Work, meet at Project Site to coordinate construction.

1. Attendees: Installer, installer of each component of associated work, installers of structure or substrate to receive Work, installers of other Work that must precede or follow Work of this Section, Design Professional, Owner's Representative, Inspection Agency, manufacturer's representative, and other representatives concerned with Work.

2. Review foreseeable methods and procedures:

    a. Tour areas of substrates, observe and evaluate condition of substrate, and other preparatory work.
    b. Review structural loading limitations of storage and work areas.
    c. Review Contract Documents.
    d. Review status of Submittals.
    e. Review Construction Schedule and verify availability of materials, Installer's personnel, equipment, and facilities.
    f. Review required inspection, testing, certifying and procedures.

3. Record discussions of conference, including decisions, agreements and unresolved issues. When unresolved issues exist at conclusion of conference, determine how they will be resolved and set date for reconvening conference.

J. Independent Inspection and Testing: Services of an independent Inspection and Testing Agency are required in conjunction with Work of this Section. Refer to Division 1.

K. Do not cover Work which is to be inspected or tested until directed by Owner's Representative.

1.7 DELIVERY, HANDLING AND STORAGE

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, handling and storage.

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

1.8 FIELD MEASUREMENTS

A. Verify that field measurements are as shown on Shop Drawings.

PART 2 PRODUCTS

2.1 MATERIALS

A. Provide recycled content materials in accordance with Sustainability Action Plan specified in Sustainability Requirements: Division 1.

B. Provide regional materials in accordance with Sustainability Action Plan specified in Sustainability Requirements: Division 1.

C. Use field applied paints and coatings that comply with the VOC limits and chemical restrictions specified in Sustainability Requirements: Division 1.

D. Coated Steel Sheet: Contractor's Option.

1. Galvanized Steel Sheet: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:

    a. Grade: 33 minimum and as required by structural performance.

b. Coating: G90 for studs and accessories in walls with masonry veneer, G-60 elsewhere.

2. Aluminum Zinc Alloy Steel Sheet: ASTM A 792/A 792M, structural steel, 55 percent aluminum-zinc-alloy coated, of grade and coating as follows:

a. Grade: 33 minimum and as required by structural performance.
b. Coating: AZ50.

2.2 FRAMING MEMBERS

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, complying with ASTM C 955, and as follows:

1. Minimum Uncoated-Steel Thickness: 0.0428 inch or as required by exterior enclosure manufacturer

2. Minimum Flange Width: 1 5/8 inches.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, complying with ASTM C 955, and as follows:

1. Minimum Uncoated-Steel Thickness: Matching steel studs.

2. Flange Width: 1 1/4 inches.

3. Provide minimum 0.1017 inch track (12 gage) for window head and sill attachment.

C. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads, and as follows:

1. Minimum Uncoated Steel Thickness: 0.0428 inch.

2. Flange Width: Minimum of 2 inches to accommodate an upward or downward vertical deflection of 1/2 inch.

D. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.

1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal and lateral loads, and as follows:

a. Minimum Uncoated Steel Thickness: 0.0428 inch.
b. Flange Width: A minimum of 2 inches to accommodate an upward or downward vertical deflection of 1/2 inch.

2. Inner Track: Of web depth indicated, and as follows:

a. Minimum Uncoated Steel Thickness: 0.0428 inch.
b. Flange Width: A minimum of 3 inches.

E. Vertical Deflection Clips: Manufacturer's standard clips, capable of accommodating upward and downward vertical displacement of primary structure.

F. Built-up Members: Built-up members of manufacturer's standard C-shaped steel section, with stiffened flanges, of web depths indicated; complying with ASTM C 955, and as follows:

1. Minimum Uncoated Steel Thickness: 0.0428 inch.

2. Flange Width: 1 5/8 inches, minimum.

2.3 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories of same material and finish used for framing members, with a minimum yield strength of 33,000 psi {230 mPa}.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. End clips.
5. Foundation clips.
6. Gusset plates.
7. Stud kickers, knee braces, and girts.
8. Hole reinforcing plates.
9. Backer plates.

2.4 ANCHORS, CLIPS AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123.

B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon steel hex-headed or headless, with encased end threaded, bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.

C. Epoxy Anchors: Fabricate from corrosion-resistant materials, with capability to sustain, without failure, a load equal to five (5) times design load except ten (10) times design load for anchors for overhead loads, as determined by testing in accordance with ASTM E 488 conducted by a qualified independent Testing Agency.

D. Mechanical Fasteners: Corrosion resistant coated, self-drilling, self threading steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
2. Size fasteners to penetrate joined members by not less than three (3) exposed screw threads.

E. Welding Electrodes: Comply with AWS standards.

2.5 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20.

B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2 1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30 minute working time.

D. Insulation: Refer to Building Insulation: Division 7.

2.6 FABRICATION

A. Fabricate cold-formed metal framing and accessories according to manufacturer's written recommendations, approved submittals and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members and fastening by power-actuated fasteners are not permitted.
4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to approved Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

2.7 SOURCE QUALITY CONTROL

A. Fabrication Tolerances: Fabricate as required to achieve tolerances indicated for Final Work or to more stringent tolerances if required to:

1. Match approved Field Sample.
2. Comply with performance criteria.
3. Comply with manufacturer's written instructions.
4. Align with other supported or adjacent work with more stringent tolerances.

PART 3 EXECUTION

3.1 EXAMINATION

A. Project Site Verification of Conditions:

1. Substrates: Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.
2. Existing Substrates: Examine conditions which will affect execution of Work.

B. Conditions: Report to Contractor prior to commencing Work.

C. Corrections: Perform corrections as directed by Owner's Representative.

D. Acceptance: Provide work required because of deficient or defective substrates at no additional cost.

3.2 PREPARATION

A. Protection: Protect adjacent surfaces from staining, deterioration or damage.

B. Preparation:

1. Before sprayed fire-resistive materials are applied, attach continuous angles, clips, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
2. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance-rating indicated. Protect remaining fire-resistive materials from damage.

3. Grout bearing surfaces uniform and level to ensure full contact of bearing flanges and track webs on supporting concrete or masonry construction.

3.3 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Comply with approved submittals.
3. Match approved Field Samples.
4. Comply with indicated criteria.
5. Comply with requirements of ASTM C 1007, unless more stringent requirements are indicated.

B. Cold-Formed Metal Framing: Shop or field fabricated for installation or field assembled.

C. Install fabricated, cold-formed framing and securely anchor to supporting structure. Bolt or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch {1.5 mm}.

D. Cut framing members by sawing or shearing; do not torch cut.

E. Fasten cold-formed metal framing members by welding or screw fastening. Wire tying of framing members and fastenings by power-actuated fasteners are not permitted.

F. Locate and install fasteners according to approved Shop Drawings.

G. Install framing members in one-piece lengths with splice connections as shown on approved Submittals.

H. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

I. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

J. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

3.4 NON-LOAD-BEARING CURTAINWALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:

1. Stud Spacing: Maximum 16 inches or as required by design.
2. Space studs for application of modular sized sheathing and insulation with minimal cutting.

C. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.

D. Isolate framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Top Track: Contractor's Option.
   a. Install single deep-leg deflection tracks and anchor to building structure.
   b. Install double deep-leg deflection tracks and anchor outer track to building structure.
2. Connect vertical deflection clips to bypassing studs and anchor to primary building structure.

E. Install horizontal bridging in curtainwall studs, spaced in rows indicated on approved Shop Drawings but not more than 54 inches {1370 mm} apart. Fasten at each stud intersection.

1. Top Bridging for Single Deflection Track:
   a. Install row of horizontal bridging within 12 inches of single deflection track.
   b. Install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or stud track solid blocking of width and thickness matching studs.
   c. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
   d. Install solid blocking at every other stud.
2. Bridging: Contractor's Option.
   a. Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
   b. Combination of flat, taut, steel sheet straps of width and thickness indicated and stud track solid blocking of width and thickness to match studs.
   c. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable curtainwall framing system.

3.5 FIELD QUALITY CONTROL

A. Tolerances:

1. General: Comply with more stringent tolerances than those listed below if required to:
   a. Match approved Mock-up.
   b. Comply with performance criteria.
   c. Comply with manufacturer's written instructions.
   d. Align with other supported or adjacent work with more stringent tolerances.

2. Level, Plumb and True to Line: Maximum allowable variation of 1/8 inch in 10 feet and maximum total variation of 1/4 inch.

3. Location: Maximum allowable variation from idealized location of 1/4 inch.

4. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

5. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch measured across diagonals.

3.6 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touch-up Painting: Wire brush, clean, and paint scarred areas, welds, and rust spots on fabricated and installed prime-painted, cold-formed metal framing. Paint framing surfaces with same type of shop paint used on adjacent surfaces.

C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure cold-formed metal framing is without damage or deterioration at Date of Substantial Completion.

END OF SECTION 054000

SECTION 055000 METAL FABRICATIONS

Part 1 GENERAL

1.1 RELATED DOCUMENTS SPECIFIED ELSEWHERE (NON-INCLUSIVE)

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Applicable Sections: Division 1.

C. Structural Steel: Division 5.

D. Metal Stairs and Railings: Division 5.

E. Ornamental Metal: Division 5.

F. Exterior Enclosure, General: Division 7.

G. Painting: Division 9.

H. Mechanical: Division 23.

I. Electrical: Division 26.

1.2 SUMMARY (NON-INCLUSIVE)

A. Section Includes: Metal items, typically custom fabricated, from plate, angles, channels, rods, bars, and other shapes as follows:

1. Counter, shelf and bench supports.
2. Overhead supports.
3. Framing and supports for accordian fire door.
4. Framing and supports for mechanical and electrical equipment.
5. Metal ladder.
6. Items indicated, but not specified elsewhere.
7. Requirements of this Section apply to miscellaneous metal work specified as Work of Divisions 23 and 26

1.3 SUBMITTALS

A. Submit per the requirements of Division 1.

B. Shop Drawings:

1. Minimum Scale:

a. Plans and Elevations for Erection: 1/4-inch equals 1-foot scale.
b. Sections: 1/2-inch equals 1-foot scale.
c. Details: 1 1/2 inches equals 1-foot scale

2. Show the following:

   a. Materials by type, shape, size and finish.
   b. Extent of shop fabrication versus field work.
   c. Joint, connection and anchorage details.
   d. Size, location and details welds.
   e. Relationship to adjacent materials and construction.
   f. Description of all loose, cast-in, and field hardware.

C. Product Data: Manufacturer's standard data for each product including written installation and maintenance instructions.

D. Calculations: Structural calculations signed and sealed by Design Engineer, licensed in State of New Jersey, to document conformance with specified design intent and criteria. Account for connection eccentricities. Submit calculations for Work indicated for Engineering.

E. Sustainability Submittals: Provide the following in accordance with Sustainability Requirements: Division 1.

1. Materials Sustainability Documentation Form.

2. Product data, certification letter, and costs for materials with recycled content.

3. Product data and costs for regional materials.

4. Product data for paints and coatings indicating VOC content and chemical composition.

1.4 SYSTEM REQUIREMENTS

A. Engineering: Engineer listed assemblies in compliance with indicated design intent and criteria.

1. Engineering is required for the following assemblies:

   a. Connections, including connections to building structure where requested by Design Professional.

2. Maintain basic dimensions of system, sight lines, jointing and profiles. Minor deviation is allowable only with approval of Design Professional and if deviations are identified on submittals.

3. Engineer components of system not fully detailed within a reasonable inference of design intent.

1.5 QUALITY ASSURANCE

A. Fabricator's Qualification:

1. Minimum five (5) years' experience producing products similar to those required for this Project.

2. Successfully provided products for three (3) projects of scope, schedule and complexity similar to this Project within last two (2) years.

B. Installer's Qualifications:

1. Minimum five (5) years' experience installing products similar to those required for this Project.

2. Successful completion of three (3) projects of scope, schedule and complexity similar to this Project within last two (2) years.

C. Welder's Qualifications: Shop and field welders shall be certified within last year per AWS D1.1. Submit certification letter.

D. Single Source Requirements: Work of this Section shall be supplied by one (1) fabricator.

E. Regulatory Requirements: Comply with the following per Division 1. OSHA Regulations for ladders.

F. Referenced Codes and Standards: Comply with the following in accordance with Division 1.

1. American Institute of Steel Construction (AISC)

   a. "Specification for Structural Steel Buildings"

2. American National Standards Institute/National Association of Architectural Metal Manufacturers (ANSI/NAAMM)

3. American Welding Society (AWS)

   a. D1.1 Structural Welding Code, Steel

4. Society for Protective Coatings (SSPC)

   a. Painting Manuals

G. Mock-up: Provide metal fabrications required for mock-up specified in Exterior Enclosure, General: Division 7.

Part 2 PRODUCTS

2.1 GENERAL

A. Provide recycled content materials in accordance with Sustainability Action Plan specified in Sustainability Requirements: Division 1.

B. Provide regional materials in accordance with Sustainability Action Plan specified in Sustainability Requirements: Division 1.

C. Use field applied paints and coatings that comply with the VOC limits and chemical restrictions specified in Sustainability Requirements: Division 1.

2.2 STEEL

A. Structural Steel Plates, Shapes and Bars: ASTM A 36/A 36M.

B. Pipe, Black or Galvanized, Seamless or Welded, Standard Weight (Schedule 40): ASTM A 53/A 53M.

C. Structural Tubing: ASTM A 500.

D. Sheet: ASTM A 1008/ A1008M or A 1011/A 1011M or A 1011/ A1011M.

2.3 STAINLESS STEEL

A. Tubing: ASTM A 554, Grade MT 304.

B. Pipe: ASTM A 312/A 312M, Grade TP 304.

C. Castings: ASTM A 743/A 743M, Grade CF 8 or CF 20.

D. Castings: ASTM A 743/A 743M, Grade CF 8M.

E. Plate: ASTM A 167, Type 304.

2.4 ACCESSORIES

A. Fasteners:

1. Fasteners into Concrete: Cast-in-place, chemical or expansion type anchors. Load Capacity in accordance with ASTM E 488: Six (6) times design load.

2. Fasteners into Steel: Welded studs, through bolts, or self-drilling or self-tapping screw type fasteners.

   a. Load Capacity: Five (5) times design load.
   b. Structural Steel Connections: Per AISC Specifications.
   c. Non-structural Connections: Per IFI Standards.

3. Powder-Actuated Fasteners: Not acceptable unless approved in writing for applications where no other type fastener is practicable. Load Capacity in accordance with ASTM E 1190: Ten (10) times-imposed load.

4. Fastener Material:

   a. Steel Work: Uncoated steel fasteners.
   b. Stainless Steel Work: Stainless steel fasteners.
   c. Galvanized Steel Work: Galvanized steel fasteners complying with ASTM A 153.

5. Fiber or Plastic Plug Type Fasteners: Not acceptable.

B. Shop Primer Paint:

1. General: Volatile Organic Compounds (VOCs) Compliant. Withstand the following tests without change in adhesion, film integrity, hardness, color, blistering or cracking:

   a. Salt Spray Resistance: ASTM B 117, 500 hours.
   b. Light and Water Resistance: ASTM D 4585, 500 hours.

2. Interior Exposure: Alkyd primer, minimum 50 percent solids by volume.

   a. GP 818 by Carboline Company.
   b. Kem Bond HS Universal Primer by Sherwin Williams.
   c. Series FD 88 by Tnemec Company.

3. Exterior Exposure and Galvanizing Touch-up Paint: Inorganic zinc-rich primer minimum 60 percent solids by volume, minimum 80 percent metallic zinc by weight in dry film.

   a. Carbo Zinc by Carboline Company.
   b. Zinc-Clad IV by Sherwin Williams.
   c. Series 90-97 by Tnemec Company.

4. Anticorrosive Paint: SSPC-Paint 20.

5. Grout: Premixed, non-shrink, non-metallic factory-packaged, non-staining, non-corrosive, nongaseous complying with ASTM C 1107.

2.5 FABRICATION

A. Shop fabricate per approved submittals.

B. Shop fabricate to the greatest extent possible.

C. Shop fabricate to comply with erection tolerances.

D. Field Measurements: Check actual dimensions prior to fabrication. Allow for trimming and fitting.

E. Welding: Conform to AWS Standards.

1. Type: 1/4 inch fillet or similar type to suit condition which allows development of full strength of joined members.

2. Welding: Continuous except where not exposed to view or weather in the finished work, weld to provide required strength of connection.

3. Finishing: Dress welds smooth.

F. Dress Work free from burrs and sharp edges.

G. Curved Work: Form to true radii without torque or folds. Start and stop curves at tangent points, unless otherwise indicated.

H. Corners: Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing Work.

I. Castings: True, sharp, and straight with all joints neatly made.

2.6 SHOP PRIMING

A. Ferrous Metals, Except Work to be Galvanized:

B. Surface Preparation:

   a. Exposed: SSPC-SP6 "Commercial Blast Cleaning".
   b. Concealed: SSPC-SP3 "Power Tool Cleaning".

C. Apply primer to surfaces, minimum dry film thickness 2.0 mils.

D. Stainless Steel:

   1. Surfaces Which Contact Other Metals: Prime with zinc chromate primer, non-bituminous dielectric material or polyisobutylene tape.

   2. Surfaces Which Contact Concrete or Masonry: Coat with anticorrosive paint.

2.7 GALVANIZING

A. Where indicated, ferrous metal, including anchorages, shall be hot-dip galvanized after fabrication. If approved in writing by Design Professional, large units may be galvanized as sub-assemblies, with final assembly by mechanical fasteners.

B. Practice: Conform to ASTM A 384, A 385 and A 780.

C. Fabrications: Hot-dip galvanize after fabrication per ASTM A 123.

D. Fasteners: Hot-dip galvanize after fabrication per ASTM A 153.

E. Finish: Do not passivate or treat with oils, grease or chemicals.

2.8 ITEMS OF WORK (NON-INCLUSIVE)

A. Overhead Supports: Structural steel shapes indicated or minimum 4 inch by 4 inch by 1/4 inch angles or channel strut framing, unless otherwise indicated.

   1. Provide overhead supports for:

      a. Toilet partitions.
      b. Accordian fire door assembly.
      c. Ceiling hung projection screens and other audio/visual equipment.
      d. Ceiling-hung equipment.
      e. Work indicated requiring overhead supports.

   2. Bracing: Brace overhead supports within 8 inches of each unsupported end and at maximum [48 inches] {1200 mm} on center with members sloped at approximately 45 degrees from horizontal. Brace in two (2) directions if not anchored to adjacent construction.

   3. Coordination: Coordinate overhead supports with supported item.

B. Rough Hardware: Custom fabricated bolts, plates, anchors, hangers, and other steel and iron shapes as indicated.

C. Loose Bearing and Leveling Plates: Steel plate, drill to receive anchor bolts.

D. Metal Ladders

1. General:

   a. ANSI A14.3 specifies minimum design requirements for ladders and safety cages.
   b. Comply with ANSI A14.3[, except for elevator pit ladders].
   c. For elevator pit ladders, comply with ASME A17.1/CSA B44.

2. Steel Ladders:

   a. Space siderails 16 inches (406 mm) apart unless otherwise indicated.
   b. Siderails: Continuous, 3/8-by-2-1/2-inch (9.5-by-64-mm steel flat bars, with eased edges.
   c. Rungs: 3/4-inch- (19-mm-) diametersteel bars.
   d. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
   e. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
   f. Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung.
   g. Provide platforms as indicated fabricated from welded or pressure-locked steel bar grating, supported by steel angles. Limit openings in gratings to no more than 1/2 inch (12 mm) in least dimension.
   h. Support each ladder[at top and bottom and not more than 60 inches (1500 mm) o.c. with welded or bolted steel brackets.
   i. Galvanize exterior ladders, including brackets.

Part 3 EXECUTION

3.1 PREPARATION

A. Furnish anchors and sleeves to be embedded in or attached to other Work. Coordinate locations.

3.2 INSTALLATION

A. Install Work in accordance with approved submittals, and in case of manufactured items, manufacturer's written instructions.

B. Embed Work into concrete or masonry to be primed/coated as indicated in Article, Shop Priming. If work is not completed in shop, then field apply indicated primers/coatings.

C. Anchoring:

1. Secure to concrete, masonry, or building structure, unless otherwise indicated.

2. Do not anchor to, non-structural elements, including metal roof deck, windows, curtainwall, or skylights.

3. Fasten to structural steel with welds or bolts.

4. Use approved expansion type anchorage for fastening Work to concrete.

5. Tack weld or peen nuts which anchor moving or vibrating machinery or which shall be concealed in finished construction.

D. Dress Work free from burrs and sharp edges.

E. Galvanized Assemblies: Do not weld, cut or abrade surfaces which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.

F. Field Welding: As indicated.

G. Loose Bearing and Leveling Plates: Set plates on shims or other adjustable devices. After bearing members have been positioned and plumbed, tighten anchor bolts. Cut-off shims flush with edges of bearing plates before grouting. Pack solidly with non-metallic non-shrink grout between bearing surfaces and plates.

H. Touch-up welds, abrasions and identification markings with matching shop primer.

I. Clean Work for field painting.

J. Erection Tolerances: As specified in the AISC Code of Standard Practice based on a standard temperature of 68 degrees F except as follows: Elements provided to support or facilitate connection of Work of other Sections shall be erected within tolerances required by those Sections.

END OF SECTION 055000

SECTION 057300 - DECORATIVE METAL RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Steel decorative railings].

B. Related Requirements:

1. Section 061000 Rough Carpentry for wood blocking for anchoring railings.

1.3 DEFINITIONS

A. Railings: Guards, handrails, and similar devices used for protection of occupants at open-sided floor areas and for pedestrian guidance and support, visual separation, or wall protection.

1.4 COORDINATION AND SCHEDULING

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible.

B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver items to Project site in time for installation.

C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not meet structural performance requirements.

1.5 ACTION SUBMITTALS

A. Product Data: For the following:

1. Manufacturer's product lines of railings assembled from standard components.
2. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, and attachment details.

C. Samples for Verification: For each type of exposed finish required.

D. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.8 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Product Options: Information on Drawings and in Specifications establishes requirements for system's aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods, including structural analysis, preconstruction testing, field testing, and in-service performance.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.

B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
1. Steel: 72 percent of minimum yield strength.

C. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ft. (0.73 kN/m) applied in any direction.
b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
b. Infill load and other loads need not be assumed to act concurrently.

2.3 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

2.4 STEEL

A. Tubing: ASTM A 500/A 500M (cold formed)

B. Bars: Hot-rolled, carbon steel complying with ASTM A 29/A 29M, Grade 1010.

C. Plates, Shapes, and Bars: ASTM A 36/A 36M.

D. Perforated Metal: ¼" perforated cold-rolled steel sheet with 1" edgebanding. Perforation pattern to be selected from manufactuerer's standard patterns.

2.5 FASTENERS

A. Fastener Materials: Unless otherwise indicated, provide the following:
1. Copper-Alloy (Brass) Components: Silicon bronze (Alloy 651 or Alloy 655) fasteners, color to match specified steel railing components.

B. Fasteners for Anchoring to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work unless otherwise indicated.

D. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308.

2.6 MISCELLANEOUS MATERIALS

A. Brazing Rods: For copper-alloy railings, provide type and alloy as recommended by producer of metal to be brazed and as required for color match, strength, and compatibility in fabricated items.

B. Intermediate Coats and Topcoats: Provide products that comply with Section "050300 Fluorpolymer Coatings"

C. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.7 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

F. Connections: Fabricate railings with welded connections unless otherwise indicated.

G. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds; no evidence of a welded joint.

H. Brazed Connections: Connect copper-alloy railings by brazing. Cope components at connections to provide close fit, or use fittings designed for this purpose. Braze corners and seams continuously.

1. Use materials and methods that match color of base metal, minimize distortion, and develop maximum strength and corrosion resistance.
2. Remove flux immediately.
3. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and brazed surface matches contours of adjoining surfaces.

I. Mechanical Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.

J. Close exposed ends of hollow railing members with prefabricated end fittings.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers, or other means to transfer loads through wall finishes to structural supports and to prevent bracket or fitting rotation and crushing of substrate.

K. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

L. Perforated-Metal Infill Panels: Fabricate infill panels from perforated metal made from same metal as railings in which they are installed.
1. Orient perforated metal with pattern parallel to top rail.

M. Toe Boards: Provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.8 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.9 STEEL FINISHES

A. For nongalvanized-steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, but galvanize anchors to be embedded in exterior concrete or masonry.

B. Preparing Nongalvanized Items for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
1. Railings Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

C. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

1. Shop prime uncoated railings with fabricator's standard shop primer compatible with top coat..

D. Shop-Painted Finish: Comply with "050300 Flouropolymer Coating".

1. Color: As indicated on drawings.

E. Powder-Coat Finish: Prepare, treat, and coat nongalvanized ferrous metal to comply with resin manufacturer's written instructions and as follows:

1. Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Treat prepared metal with iron-phosphate pretreatment, rinse, and seal surfaces.
3. Apply thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils (0.04 mm).
4. Color: Match Architect's sample.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (5 mm in 3 m).

C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1. Coat concealed surfaces that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.2 RAILING CONNECTIONS

A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

3.3 ANCHORING POSTS

A. Cover anchorage joint with flange of same metal as post, welded to post after placing anchoring material.

B. Anchor posts to metal surfaces with flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
1. For steel railings, weld flanges to posts and bolt to metal-supporting surfaces.

3.4 ATTACHING RAILINGS

1. For steel-framed partitions, fasten brackets directly to steel framing or concealed steel reinforcements using self-tapping screws of size and type required to support structural loads.

3.5 CLEANING

A. Clean aluminum and stainless steel by washing thoroughly with clean water and soap, rinsing with clean water, and wiping dry.

B. Clean copper alloys according to metal finisher's written instructions in a manner that leaves an undamaged and uniform finish matching approved Sample.

C. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

3.6 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 057300

SECTION 057500 **DECORATIVE FORMED METAL**

Part 1 GENERAL

1.1 RELATED DOCUMENTS SPECIFIED ELSEWHERE (NON-INCLUSIVE)

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Applicable Sections: Division 1.

C. Architectural Woodwork: Division 6.

D. Joint Sealants: Division 7.

E. Painting: Division 9.

~~F. Hydraulic Elevators: Division 14.~~

1.2 SUMMARY (NON-INCLUSIVE)

A. Section Includes: Custom-fabricated items and/or custom-fabricated components to be part of standard manufacture products including:

1. Finish Metal for mill work.
2. Pedestals for automatic door operators at building entrances.

1.3 COORDINATION

A. Coordinate installation of anchorages for decorative formed metal items. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver items to Project site in time for installation.

B. Coordinate installation of decorative formed metal with adjacent construction to ensure that wall assemblies, flashings, trim, and joint sealants, are protected against damage from the effects of weather, age, corrosion, and other causes of deterioration.

1.4 SUBMITTALS

A. Submit per the requirements of Division 1.

B. Shop Drawings: Indicating fabrication and installation of ornamental metalwork including plans, elevations and details of components and attachments to other units of Work. Indicate materials, profiles of each ornamental metalwork member and fitting, joinery, finishes, fasteners, anchorages and accessory items.

1. Include setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed as unit of Work of other Sections.

C. Product Data: For each product used in ornamental metalwork, including finishing materials and methods.

D. Samples:

1. For Verification Purposes: Of each type of metal finish required, prepared on metal of same thickness and alloy indicated for final unit of Work. Where finishes involve normal color and texture variations, include Sample Sets composed of two (2) or more units indicating full range of variations expected.

   a. Include 6-inch-long Samples of linear shapes.
   b. Include 6-inch square of plates.
   c. Include two (2) full-size Samples of castings and forgings.

E. Qualifications: For firms and persons specified in Article, Quality Assurance to demonstrate their capabilities and experience. Include list of completed projects with project name, addresses, name of Design Professional and Owners, plus other information specified.

F. Sustainability Submittals: Provide the following in accordance with Sustainability Requirements: Division 1.

1. Materials Sustainability Documentation Form.
2. Product data, certification letter, and costs for materials with recycled content.
3. Product data and costs for regional materials.
4. Product data for adhesives and sealants indicating VOC content.
5. Product data for paints and coatings indicating VOC content and chemical composition.

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1.5 REFERENCE STANDARDS

A. Referenced Codes and Standards: Comply with the following in accordance with Division 1.

1. American National Standards Institute (ANSI) A 117.1 Buildings and Facilities: Providing Accessibility and Usability for Physically Handicapped People
2. The Department of Justice
   a. Americans with Disabilities Act (ADA) Accessibility Guidelines (ADAAG) for Buildings and Facilities

B. State of New Jersey Building Code

1. State of New Jersey Accessibility Code

1.6 QUALITY ASSURANCE

A. Supplier/Installer/Finisher Qualifications: Firm engaged for this Work shall have a minimum of ten (10) years finishing experience in fabricating installing finishing work of this magnitude and quality. Submit certification if requested.

1.7 DELIVERY, HANDLING AND STORAGE

A. Protect ornamental metal work during handling, shipment, installation from any damage until Date of Substantial Completion.

B. Protection shall be adequate and as best suited for length of time protection will remain in place. Provide wrappings, peelable film, crating during transport, as required.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls, columns, beams, and other construction contiguous with decorative formed metal by field measurements before fabrication and indicate measurements on Shop Drawings.

Part 2 PRODUCTS

2.1 MATERIALS

A. General: Provide ornamental metalwork composed of metals of forms and types which comply with requirements of referenced standards and which are free from surface blemishes where exposed to view in finished unit. Exposed-to-view surfaces exhibiting pitting, seam marks, roller marks, "oil canning", stains, discolorations or other imperfections on finished units are not acceptable.

B. Provide recycled content materials in accordance with Sustainability Action Plan specified in Sustainability Requirements: Division 1.

C. Provide regional materials in accordance with Sustainability Action Plan specified in Sustainability Requirements: Division 1.

D. Use adhesives and sealants that comply with the VOC limits specified in Sustainability Requirements: Division 1.

E. Use field applied paints and coatings that comply with the VOC limits and chemical restrictions specified in Sustainability Requirements: Division 1.

F. Stainless Steel: Type 302 or 304, ASTM A 276/A 276M or A 167/167M, as applicable to bars, or plate, sheet and strip materials, respectively in (AISI No. 4, Satin Finish) (AISI No. 7, Semi-Polished Finish) (AISI No. 8, Polished Finish).

G. Structural Steel: Structural grade, open hearth, hot-rolled, ASTM A 36/A 36M.

H. Tubing: ASTM A 500 or A 501.

I. Architectural Steel: Of such metallurgical, temper and other basic classifications which are proper, and manufacturer recommended to produce ornamental metal work which has smooth and uniform surfaces, structural soundness, proper machining quality where required, flatness without surface defects, and without oil-canning effect in the case of sheet metal. Steel used shall provide stability when fabricated, fastened, welded, connected, and otherwise completed as ornamental metal work. Identify steel type or types by ASTM or AISI reference numbers on Shop Drawings for information and record.

J. Fasteners: Of similar material to that joined, unless otherwise indicated. Steel fasteners shall be galvanized.

K. Welding Materials: Conform to AWS Standards for welding.

L. Prime Paint for Ferrous Metal: Basic lead silicon-chromate primer applied to dry film thickness of 2.5 mils.

M. Prime galvanized metal with zinc oxide primer applied to dry film thickness of 2.9 mils.

N. Dielectric Isolation Material: A coat of heavy-bodied asphalt-base paint or asphalt tape, applied over shop prime coat on steel. Non-bituminous material, such as butyl compound or polyisobutylene tape may be used.

2.2 FABRICATION: GENERAL

A. Shop Assembly: Preassemble decorative formed metal items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Coordinate dimensions and attachment methods of decorative formed metal items with those of adjoining construction to produce integrated assemblies with closely fitting joints and with edges and surfaces aligned unless otherwise indicated.

C. Provide support framing, mounting and attachment clips, splice sleeves, fasteners, and accessories needed to install decorative formed metal items.

D. General:

1. Form, fit, fabricate ornamental metal work with precision in dimensioning, machining to hairline joints, smoothing surfaces to uniformity of like Work, free of defects, warp, offsets, and other faults.

2. Form and fabricate Work in shop. Minimize need for field joints.

3. Class of fabrication shall be that of fine architectural metal work.

4. Allow for thermal movement, maximum temperature change 100 degrees F

5. Mill joints to a tight, hairline fit. Cope or miter corner joints. Forms joints exposed to weather to exclude water penetration.

6. Provide castings that are sound and free of warp or defects which impair strength and appearance.

7. Finish exposed surfaces to smooth, sharp, well-defined lines and arises.

8. Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

E. Stainless Steel Work:

1. Stainless steel work shall be welded construction, unless otherwise indicated on Drawings. Dress welds and finish welded surface to match adjacent stainless steel surface finish.

2. Direction of graining shall be parallel with brake-formed edges of fabricated members. In sheet work, graining shall be vertical in completed Work.

3. Unless otherwise indicated on Drawings, minimum thickness of sheet materials shall be [0.063 inch] {1.6 mm}. Unless otherwise indicated on Drawings, minimum wall thickness of round or tubular members shall be [0.067 inch] {1.7 mm}.

4. After grinding welds flush, refinish stainless steel by hand rubbing with No. 00 aluminum oxide emery cloth and light oil, then wipe clean with pumice powder. Use extra care so that original finish is matched.

F. Architectural Steel Work:

1. Fabricate architectural steel work to meet requirements of "Specification for Architecturally Exposed Structural Steel" published by AISC. Unless otherwise indicated, connections which are exposed to view in complete Work shall be made by groove welding, welds ground flush with adjacent surfaces. When open joints are not indicated, machine edges of joints for close fit without gaps.

2. Mechanical fastenings shall be concealed from view in completed work. Where exposed mechanical fastenings cannot be avoided, type of fastenings shall be subject to approval for appearance and shall be installed weathertight.

3. Hot-dip galvanize architectural steel work after fabrication and apply a smooth prime coat paint application.

4. Perform sheet steel work to same high-quality standards of hollow metal industry, using galvanized sheet metal, minimum l6 USS gauge, unless otherwise indicated.

2.3 FILLER PANELS

A. Form filler panels for closing ends of partition systems and for other applications indicated. Form from two sheets of metal of type and thickness indicated below, separated by channels formed from the same material, producing a panel of same thickness as partitions or mullions unless otherwise indicated. Incorporate reveals, trim, and concealed anchorages for attaching to adjacent surfaces.

1. Filler panels may be fabricated from prefinished metal sheet in lieu of finishing after fabrication provided unfinished edges are concealed from view.

B. Adhesively attach gaskets to filler panel edges where they abut mullions or glazing. Use 1-inch- square material, unless otherwise indicated, set approximately 1/4 inch into channeled edge of filler panel.

C. Attach gaskets to all edges of panels that abut adjacent surfaces to form a continuous seal. Use compressible gaskets or mastic sealing tape, applied to center of panel edges to be concealed from view, unless otherwise indicated.

D. Do not mechanically fasten filler panels to mullions.

2.4 FINISHES: GENERAL

A. Comply with NAAMM "Metal Finishes Manual" for written recommendations relative to application and designations of finishes.

1. Protect mechanical finishes on exposed surface from damage by application of strippable temporary protective covering prior to shipment.

B. Stainless Steel Finishes:

1. Finish designations prefixed by AISI conform with the system established by American Iron and Steel Institute for designating finishes for stainless steel sheet. The basis of design for scheduled stainless steel finishes is Excelsior Steel Processing Ltd., 34 Carson Street, Toronto, ON, M8W 3R9, Phone: 416-255-5521

2. Refer to Drawings for finish information:

a. Bright, Cold-Rolled Unpolished Finish: AISI No. 2B finish.
b. Bright, Directional Polish: AISI No. 4 finish.

C. Steel and Iron Finishes:

1. Preparation for Paint Finish: Clean surfaces of dirt, grease, and loose rust or mill scale, including items fabricated from galvanized steel, if any, followed by a conversion coating of type suited to organic coating applied over it.

2. Factory-Primed Finish: Apply air-dried primer immediately following cleaning and pretreatment, to provide a minimum dry film thickness of 2.0 mils per applied coat, to surfaces which will be exposed after assembly and installation, and to concealed, nongalvanized surfaces.

D. Aluminum Finishes

1. Refer to Division 5 for Flouropolymer Coating requirements,

Part 3 EXECUTION

3.1 PREPARATION

A. Coordinate and furnish anchorages and setting drawings, diagrams, templates, written instructions and directions for installation of items having integral anchors which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project Site.

B. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of decorative formed metal.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

D. Acceptance: Commencing Work constitutes acceptance of substrate. Future work or re-work required because of deficient substrates will be performed at no expense to the Owner.

3.2 INSTALLATION

A. Provide anchorage device and fasteners where necessary for securing ornamental metal items to in-place construction; including, threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connectors as required.

B. Perform cutting, drilling and fitting required for installation of ornamental metalwork. Set products accurately in location, alignment and elevation, plumb, level and true, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items which are to be built into concrete, masonry or similar construction.

C. Fit exposed connections accurately together to form tight, hairline joints or, where indicated, with uniform reveals and spaces for sealants and joint fillers. Where cutting, welding and grinding are required for proper shop fitting and jointing of ornamental metal items, restore finishes to eliminate any evidence of such corrective Work.

D. Do not cut or abrade finishes which cannot be completely restored in field. Return items with such Finishes to shop for required alterations, followed by complete refinishing or provide new units as required.

E. Install concealed gaskets, joint fillers, insulation and flashing as Work progresses, so as to make work weathertight, soundproof or lightproof as required.

F. Restore protective coverings which have been damaged during shipment or installation of Work. Remove protective coverings only when there is no possibility of damage from other work yet to be performed at same location.

1. Retain protective coverings intact and remove simultaneously from similarly finished items to preclude non-uniform oxidation and discoloration.

G. Field Welding: Comply with applicable AWS Specification for procedures of manual shielded metal-arc welding, for appearance and quality of weld made, and for methods used in correcting welding work. Weld connections which are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Grind exposed welded joints smooth and restore finish to match finish of adjacent rail surfaces.

H. Corrosion Protection: Coat concealed surfaces of aluminum, which will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of anticorrosive paint or zinc chromate primer.

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3.3 ADJUSTING AND CLEANING

A. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed area with same material.

B. Touch-Up Painting: Cleaning and touch-up painting of field welds, bolted connections, and abraded areas of shop paint is specified in Painting: Division 9.

C. For Galvanized Surfaces: Clean field welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

D. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

E. Clean according to metal finisher's written instructions in a manner that leaves an undamaged and uniform finish matching approved Sample.

3.4 PROTECTION

A. Protect finishes of ornamental metalwork from damage during Construction Period by use of temporary protective coverings approved by ornamental metalwork fabricator. Remove protective covering at Date of Substantial Completion.

B. Restore finishes damaged during installation and Construction Period so that no evidence remains of correction work. Return items which cannot be refinished in field to shop; make required alterations and refinish entire unit, or provide new units as required.

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END OF SECTION 057500

SECTION 061000 ROUGH CARPENTRY

Part 1 GENERAL

1.1 RELATED DOCUMENTS SPECIFIED ELSEWHERE (NON-INCLUSIVE)

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Applicable Sections: Division 1.

C. Sheathing: Division 6.

D. Architectural Woodwork: Division 6.

1.2 SUMMARY (NON-INCLUSIVE)

A. Section Includes: Wood framing, furring and blocking, including fasteners and accessories generally concealed in finished Work or exposed only in utility spaces.

1.3 SUBMITTALS

A. Submit per the requirements of Division 1.

B. Product Data: For preservative and fire-retardant treated material.

C. Certifications: For lumber and wood treatments.

D. Sustainability Submittals: Provide the following in accordance with Sustainability Requirements: Division 1.

1. Materials Sustainability Documentation Form.
2. Product data, certification letter, and costs for materials with recycled content.
3. Product data and costs for regional materials.
4. Product data, costs, and chain-of-custody certificates for products containing certified wood.
5. Product data for adhesives and sealants indicating VOC content.
6. Product data for paints and coatings indicating VOC content and chemical composition.
7. Product data for products containing composite wood or agrifiber products or wood glues indicating that they do not contain urea-formaldehyde resin.

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1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with the following per Division 1.

1. Conform to applicable building code for fire-retardant treatment of wood surfaces for flame spread and smoke developed ratings.
2. Fire-retardant treatment to conform to requirements of Underwriters Laboratories Inc. (UL).

B. Referenced Codes and Standards: Comply with the following in accordance with Division 1.

1. Lumber: Identify with grade stamp of an agency certified by NFPA and WWPA.

2. American Plywood Association (APA) Product Guide: Performance-rated Panels.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

Part 2 PRODUCTS

2.1 MATERIALS

A. Provide recycled content materials in accordance with Sustainability Action Plan specified in Sustainability Requirements: Division 1.

B. Provide regional materials in accordance with Sustainability Action Plan specified in Sustainability Requirements: Division 1.

C. Provide certified wood-based materials in accordance with Sustainability Action Plan specified in Sustainability Requirements: Division 1.

D. Do not use products or adhesives that contain urea-formaldehyde resin.

E. Use adhesives and sealants that comply with the VOC limits specified in Sustainability Requirements: Division 1.

F. Use field applied paints and coatings that comply with the VOC limits and chemical restrictions specified in Sustainability Requirements: Division 1.

G. Lumber: Material concealed from view in the finished Work. Lumber and sizes shall comply with DOC PS-20. Use dry lumber (S-DRY), surfaced four sides (S4S). Moisture content shall not exceed 19 percent except that moisture content of 2-inch lumber shall not exceed 15 percent at time of surfacing. Stamp lumber "S-DRY" and "MC-15" respectively. Lumber shall conform to WWPA Grading Rules as follows for all sizes, nominal:

1. Structural Light Framing (Construction Grade): Lumber 2 inches to 4 inches thick and 2 inches to 4 inches wide.

2. Structural Joists and Planks (No. 2 or Standard Grade): Lumber 2 inches to 4 inches thick and 5 inches and wider (nominal).

3. Construction Boards (No. 2 or Standard Grade): Lumber 1 1/2 inches and thinner.

H. Plywood: As recommended by "Guide to Plywood Grades under Product Standard PS-1 for Softwood Plywood/Construction and Industrial" published by American Plywood Association, unless otherwise indicated.

1. Interior plywood exposed to view: "A" Veneer Grade.

2. Electrical/Telephone Backing Panels: "C" Grade Face, exposure 1, fire-retardant treated, 3/4 inches nominal.

I. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

1. Allowable design stresses, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 PRESERVATIVE WOOD TREATMENT

A. General: Comply with AWPA Standard C2. Provide arsenic and chromium-free treatment conforming to AWPA C2. Isolate treated wood from adjacent metal with building felt separator. Mark each piece with AWPA or SPIB Quality Mark Requirements.

B. Provide treatment materials for field cut surfaces.

C. Aboveground Wood Treatment: Pressure treat to a minimum retention of 0.25 pcf

1. Kiln-dry lumber to maximum 19 percent moisture content.
2. Kiln-dry plywood to maximum 15 percent moisture content.
3. Treat aboveground wood where indicated and as follows:
    a. In contact with roofing, roof insulation, flashing or waterproofing.
    b. In contact with concrete or masonry on exterior side of cavity walls.
    c. Exterior locations more than 18 inchesabove grade.

D. Ground-Contact Wood Treatment: Pressure treat to a minimum retention of 0.40 pcf

1. Treat ground-contact wood where indicated and as follows:
    a. Totally or partially embedded in earth or in concrete embedded in earth.
    b. At exterior locations described for above ground usage, but within 18 inches of grade.

2.3 FIRE-RETARDANT PRESSURE TREATMENT

A. Lumber: Comply with AWPA C 20.

B. Plywood: Comply with AWPA C 27.

C. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Treatment shall not promote corrosion of metal fasteners.
2. Exterior type is suitable for both exterior and interior applications. Interior type is only for interior applications.
3. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
4. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.

D. Treatment: Type A for interior work and protected exterior work, Exterior Type for exterior locations exposed to elements.

E. Provide UL listed identification on fire-retardant treated materials.

F. Provide fire-retardant treated all lumber and plywood on interior and exterior of building, unless otherwise indicated.

2.4 ROUGH HARDWARE

A. Provide hardware of size, type, and quantity required to permanently secure Work. Hardware shall include nails, spikes, screws, anchor bolts, lag bolts, toggle bolts, or other approved fasteners.

B. Hardware:

1. Use in fire retardant treated material: Hot-dipped galvanized per ASTM A 153, or stainless steel.
2. Use in preservative treated material: Stainless steel.

C. Nails shall be barbed or ring-shank type and penetrate minimum 1 1/4 inch into substrate.

D. Fasteners into concrete shall be one (1) of the following as suitable to condition:

1. Hardened Concrete: Minimum No. 10 screws, in pre-drilled holes.
2. Explosive set anchors, minimum 1 inch penetration.
3. Epoxy anchors in pre-drilled holes.
4. No hand driven nails allowed.
5. No lead, fiber or plastic shields or plugs allowed.

E. Fasteners into structural steel shall be one (1) of the following as suitable to condition:

1. Screws, minimum 1/4 inch self-drilling/self-tapping or in pre-drilled and tapped holes.
2. Explosive set anchors, minimum 1/4 inch penetration.

F. Fasteners into sheet metal, [12 gage] {2.7 mm} and under, shall be screws, minimum No. 8 self-drilling/self-tapping.

Part 3 EXECUTION

3.1 INSTALLATION

A. Comply with American Forest and Paper Association (AFPA) "National Design Specification for Wood Construction" and "Wood Frame Data No. 1".

B. Construct members of continuous pieces of longest possible lengths.

C. Install Work plumb, level, and true of shape and configuration indicated.

D. Coat cut surfaces of preservative treated wood to comply with AWPA M 4.

E. Anchors:

1. Nailing: As scheduled in applicable building code, unless otherwise indicated.
2. Provide bolts with plate washers.
3. Recess heads of screws and bolts below surface of member where indicated or required for future Work.

F. Blocking, Nailers Edge Strips and Cants at Roofing:

1. Provide at perimeter of roof, around openings through roof, and where roof abuts walls, curbs, and other vertical surfaces.
2. Unless otherwise indicated, members shall be nominally 6 inches wide by thickness of insulation layers.
   a. At nailers on metal decking parallel to flutes, increase width of members as required to span minimum two (2) flutes with 3/4 inch bearing each side.
   b. Bottom layer of members shall be nominal 1 1/2 inch minimum.
3. Install members in longest lengths possible. Offset joints between members by minimum 4 feet .
4. Anchor members to structure as follows:
   a. Ends of Members: Provide anchors within 6 inches of ends.

b. Members Over 4 Inches Wide: Stagger anchors in offset rows and double at ends.
c. Concrete Masonry Units: 1/2 inch diameter anchor bolts with 2 inch 90 degree leg at 4 feet { on center maximum. Minimum 12 inch embedment into grouted core.
d. Concrete and Bond Beams: 1/2-inch diameter expansion bolts at 3 feet on center or double staggered row of masonry screws, each 12 inches on center.
e. Structural Steel: Double staggered row of No. 10 self-drilling, self-tapping screws with washers, each 2 feet on center.
f. Metal Deck: Double row of No. 10 screws with washers, each 2 feet on center.
g. Corner Zones: For a distance of minimum 8 feet from each corner, double the number of fasteners by decreasing spacing to half of spacing listed above.

5. Anchor Members to Each Other: Use nails which penetrate minimum 1 1/4 inch into wood layers below in two (2) staggered rows, each 24 inches on center or 3/8 inch lag bolts in two (2) staggered rows, each 4 feet on center.

6. Kerf or slot members at 12-inch centers approximately 1/2 inch by 1/2 inch to allow venting of roof.

G. Install wood blocking required for level installation of roof curb mounted items (for example, fans, air handling units, and other motor-driven equipment). Set fasteners flush if required to clear abutting work.

H. Blocking and Nailers to Support Woodwork and Millwork specified in other Sections:

1. Provide minimum 3/4 inch thick material for screw attachment or 1 1/2 inch thick material for nail attachment.

2. Provide blocking and nailers continuous behind, for example, all standing and running trim, casework, cabinets, wall-mounted shelving, countertops, cleats, finish carpentry, millwork and as indicated.

I. Blocking and Nailers to Support Wall-mounted Elements:

1. Provide minimum 1 1/2-inch-thick material.

J. Provide blocking and nailers continuous behind every wall mounted element including, but not limited to, finish hardware, toilet accessories, furniture, signage, architectural accessories, wall guards and handrail brackets.

END OF SECTION 061000

SECTION 061600 SHEATHING

Part 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1. Applicable Sections: Division 1.
2. Cold-Formed Metal Framing (CFMF): Division 5.
3. Air / Vapor Barriers: Division 7.

1.2 SUMMARY (NON-INCLUSIVE)

A. Section Includes: Panel type sheathing applied to structural framing. Included are attachments and accessories. Sheathing shall be covered in Finished Work.

1. Wall sheathing.
2. Roof sheathing.
3. Parapet sheathing.
4. Composite nail base insulated roof sheathing.
5. Subflooring.
6. Underlayment.
7. Sheathing joint and penetration treatment.

1.3 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections, to ensure that interior architectural woodwork can be supported and installed as indicated.

1.4 SUBMITTALS

A. Submit per the requirements of Division 1.

1. Product Data: For preservative and fire-retardant treated material.
2. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
3. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.

4. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5516.
5. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
6. For air-barrier and water-resistant glass-mat gypsum sheathing, include manufacturer's technical data and tested physical and performance properties of products.

1.5 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following products, from ICC-ES.

1. Preservative treated material.
2. Fire retardant treated material.
3. Gypsum Sheathing.

B. Field quality-control reports

1.6 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with the following per Division 1.

1. Conform to applicable building code for fire-retardant treatment of wood surfaces for flame spread and smoke developed ratings.
2. Fire-retardant treatment to conform to requirements of Underwriters Laboratories Inc. (UL).

B. Referenced Codes and Standards: Comply with the following in accordance with Division 1.

1. American Plywood Association (APA)

Design/Construction Guide: Performance-Rated Panels

Design/Construction Guide: Residential and Commercial

2. American Wood-Preservers' Association (AWPA)

C 9 Plywood: Preservative Treatment by Pressure Processes

C 27 Plywood: Fire-Retardant Treatment by Pressure Processes

M 4 Standard for The Care Of Preservative: Treated Wood Products

3. Gypsum Association (GA)

253 Application of Gypsum Sheathing

4. National Institute of Standards and Technology, Department of Commerce, Product Standard (PS)

1 Construction and Industrial Plywood

1.7 DELIVERY, HANDLING AND STORAGE

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

Part 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: As tested according to ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2. Air-Barrier Performance: Air-barrier and water-resistant gypsum sheathing assembly, and seals with adjacent construction, shall be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations tie-ins to other installed air barriers, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

2.2 MATERIALS

A. Provide recycled content materials in accordance with Sustainability Action Plan specified in Sustainability Requirements: Division 1.

B. Provide regional materials in accordance with Sustainability Action Plan specified in Sustainability Requirements: Division 1.

C. Do not use products or adhesives that contain urea-formaldehyde resin.

D. Use adhesives and sealants that comply with the VOC limits specified in Sustainability Requirements: Division 1.

E. Gypsum Sheathing: Weather resistant gypsum core panel without paper faces and edges conforming with ASTM C 1177. "Dens-Glass Gold" by Georgia Pacific, "Fiberrock Aqua-tough" Sheathing by USG, or "GlasRoc" by CertainTeed. No Substitutions.

1. Size: 5/8-inch-thick, 4 feet wide by longest practical length.

2. Type: Type X for rated systems and used as a component of the exterior wall construction assembly. ASTM C 1396/C 1396M, gypsum sheathing; with water-resistant-treated core and with water-repellent paper bonded to core's face, back, and long edges.

3. Joint Tape: 2 inches, 10 by 10 glass mesh tape.

4. Trim: As recommended in writing by manufacturer and complying with ASTM D 1784. All trim shall be the spackled type.

5. Compound: Setting type joint compound as recommended in writing by manufacturer.

F. Accessories:

1. Fasteners: Type recommended in writing by panel manufacturer, hot-dip galvanized per ASTM A 153. Screws for metal framing shall be self-drilling, self-tapping for metal thickness of framing.

a. Fasteners into preservative treated lumber or plywood: stainless steel.

Part 3 EXECUTION

3.1 EXAMINATION

A. Examine framing or substrate to receive sheathing for conformance to requirements and suitability for sheathing. Notify Contractor of deficiencies and do not proceed until they are remedied.

B. Prepare framing or substrate for sheathing application by installing blocking of pressure-treated wood, minimum [2 inches by 4 inches or cold formed metal studs matching size and thickness of adjacent framing. Provide blocking at unsupported edges of sheathing.

3.2 INSTALLATION

A. Fire-rated assemblies shall be installed in conformance with requirements of listing agency.

B. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

C. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

D. Coordinate sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

G. Gypsum Sheathing: Install in accordance with manufacturer's written instructions and applicable published instructions in GA-253.

1. Install sheathing horizontally or vertically in maximum lengths practical.
   a. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent panels without forcing. Abut ends over centers of studs, and stagger end joints of adjacent panels not less than one stud spacing. Attach at perimeter and within field of panel to each stud.
   b. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.
2. Attach to framing or substrate with screws 6 inches on center at perimeter and in field. Do not countersink fasteners.
3. Install trim pieces where exterior gypsum sheathing abuts differing materials and as indicated. Provide control joints maximum 30 feet on center.
4. Seal and tape all joints in accordance with manufacturer's written instructions.
   a. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
   b. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

3.3 FIELD QUALITY CONTROL

A. Testing and Inspecting Agency Engage a qualified testing agency to perform tests and inspections.

B. Inspections: Air-barrier and water-resistant glass-mat gypsum sheathing, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:

1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.

2. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
3. Termination mastic has been applied on cut edges.
4. Strips and transition strips have been firmly adhered to substrate.
5. Compatible materials have been used.
6. Transitions at changes in direction and structural support at gaps have been provided.
7. Connections between assemblies (sheathing and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
8. All penetrations have been sealed.

C. Tests: As determined by testing agency from among the following tests:

1. Air-Leakage-Location Testing: Air-barrier sheathing assemblies will be tested for evidence of air leakage according to ASTM E 1186, chamber pressurization or depressurization with smoke tracers
2. Air-Leakage-Volume Testing: Air-barrier assemblies will be tested for air-leakage rate according to ASTM E 783
    a. Air barriers will be considered defective if they do not pass tests and inspections.
    b. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.
    c. Prepare test and inspection reports.

3.4 PROTECTION AND REPAIR

A. Protect sheathing and air infiltration barrier from damage and excessive weathering until installation of overlying materials.

B. Repair damage to sheathing and air infiltration barrier, as approved by Design Professional, prior to application of overlying materials.

END OF SECTION 061600

SECTION 064023 **INTERIOR ARCHITECTURAL WOODWORK**

Part 1 GENERAL

1.1 . RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Applicable Sections: Division 1.

C. Dimensional Stone: Division 4.

D. Ornamental Metal: Division 5.

E. Rough Carpentry: Division 6.

F. Joint Sealants: Division 7.

G. Wood Doors: Division 8.

H. Painting: Division 9.

1.2 SUMMARY (NON-INCLUSIVE)

A. Section Includes:

1. Interior Standing and running trim.
2. Decorative wood and wood paneling.
3. Base and wall cabinets.
4. Plastic laminate trim panels.
5. Wood Door veneers.
6. Wood furring, blocking, shims, and hanging strips for installing interior architectural woodwork items that are not concealed within other construction.
7. Shop priming of interior architectural woodwork
8. Shop finishing of interior architectural woodwork

1.3 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections, to ensure that interior architectural woodwork can be supported and installed as indicated.

B. Notify the design professional before installing any devices on woodwork. Electrical, Plumbing and other fixtures mounted within, or adjacent to woodwork shall be avoided. Coordinate if required and approved by design professional cut-outs using manufacturer's templates and field measurements to verify actual installed locations and dimensions.

1.4 SUBMITTALS

A. Submit per the requirements of Division 1.

1. Submit together with submittals for Hydraulic Elevators: Division 14.

B. Sustainability Submittals: Provide the following in accordance with Sustainability Requirements: Division 1.

1. Materials Sustainability Documentation Form.
2. Product data, certification letter, and costs for materials with recycled content.
3. Product data and costs for regional materials.
4. Product data, costs, and chain-of-custody certificates for products containing FSC certified wood.
5. Product data for adhesives and sealants indicating VOC content.
6. Product data for paints and coatings indicating VOC content and chemical composition.
7. Product data for products containing composite wood or agrifiber products or wood glues indicating that they do not contain urea-formaldehyde resin.
8. Certifications of FSC Chain of Custody Certificates for fabricator / manufacturer

C. Shop Drawings: Show fabrication, dimensions, materials, interface with other construction, anchoring, and installation. Show provisions for conformance with indicated criteria. Show extent of shop fabrication versus field work.

1. Minimum Scale:
    a. Overall Plans and Elevations: Minimum 1/4-inch equals 1 foot scale.
    b. Plans and Elevations of Components: 1-inch equals 1 foot scale.
    c. Details: Minimum 3-inch equals 1 foot scale.
    d. Typical profiles for each piece: Full size.
2. Show locations and sizes of furring, blocking, and hanging strips, including co blocking and reinforcement concealed by construction and specified in other Sections.
3. Show locations and sizes of cutouts and holes for light fixtures, data equipment and other items installed in architectural woodwork.
4. Show veneer leaves with dimensions, grain direction, exposed face.
5. Show field datum line for work with a consistent horizontal design element including, but not limited to, aligned door heads, paneling and wainscots. Show datum to establish field measurements for Shop Drawings and Production.

D. Product Data: On each material, anchor and accessory and miscellaneous product. Indicate provisions for conformance with indicated criteria. Include the following:

1. Materials: For panel products, high pressure decorative laminate, adhesive for bonding plastic laminate, and fire-retardant treated materials.
2. Fire Retardant Treatment: Include data and warranty information from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include chemical-treatment manufacturer's written instructions for finishing treated material and manufacturer's written warranty
3. Waterborne Treatments: For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
4. Hardware and Accessories: For each type of product indicated, including hardware for toilet room stall compartments, accessories and finishing materials and processes.

E. Samples:

1. For Initial Selection: Photographs of manufacturer's available logs of each specified veneer species for selection by Design Professional prior to fabrication. Veneer for doors and elevators should be from a single source.

2. For Initial Selection: Manufacturer's color charts consisting of units or sections of units indicating full range of colors, textures and patterns available for each type of material indicated.

   a. Shop applied transparent finishes.
   b. Shop applied opaque finishes.
   c. Plastic laminates.

3. Samples for verification of the following:

   a. Lumber with or for Transparent Finish: Approximately 5 inches wide by 24 inches long, for each species and cut, step finished on one (1) side and one (1) edge.
   b. Veneer Leaves: 8 inches by 10 inches number required to represent full range of variation of color, grain and texture, selected from flitches to be used for transparent finished woodwork.
   c. Wood Veneer Faced Panel Products with or For Transparent Finish: 8 inches by 10 inches, step finished on one (1) side and one (1) edge, for each species, cut and finish. Number of panels as required to represent full range of variation of color, grain and texture, selected from flitches to be used for finished woodwork.

      1) Include at least one (1) face-veneer seam and finish as specified.

   d. Panel Products with Shop Applied Finish: 50 square inches for lumber and 8 inches by 10 in for panels. Furnish Sample of each species, finish system and color. Provide step layered finish on one (1) side and one (1) edge.
   e. Plastic Laminate Clad Panel Products: 8 inches by 10 inches, for each type, color, pattern, and surface finish with backer laminate.

4. Sample Assemblies:

   a. Cabinet Front Frame Joints Between Stiles and Rail With Exposed End Pieces: Minimum 18 inches high by 18 inches wide by 6 inches deep.
   b. Countertop, minimum 24 inches long, including front profile, backsplash and side splashes.
   c. Intersection of four (4) panels, minimum 24 inches square, including mounting and reveal moldings.

5. Cabinet Hardware and Accessories: One (1) unit for each type and finish.

F. Qualifications: Proof of compliance with indicated qualifications.

G. Quality Control Procedures: Indicating compliance with indicated criteria:

1. Factory Quality Control Procedures.

2. Factory Test Procedures.

3. Factory Test Reports.

4. Field Test Procedures.

5. Field Test Reports.

H. Certifications: Certification letters as indicated.

1. Certification of fire-retardant treatment and preservatives. Include certification by treating plant indicating type of chemicals used and fire performance characteristics achieved.

1.5 DEFINITIONS

A. Exposed Surfaces: Surfaces visible in the finished Work when viewed from any sightline between 3 feet to 7 feet 6 inches above finished floor, when doors and drawers are closed; bottoms of casework more than 4 feet above finished floor, backs of hinged doors, and edges of hinged doors exposed when opened.

B. Semi-Exposed Surfaces: Surfaces that become visible when drawers and doors are opened and tops of cases [7 feet 6 inches] or more above finished floor.

C. Concealed Surfaces: Surfaces not visible after installation.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1. Experience: Minimum five (5) years producing architectural woodwork similar to those required for this Project and provided architectural woodwork for three (3) projects of scope, schedule and complexity similar to this Project within last two (2) years, as acceptable to Design Professional.

2. Fabricators, Detailers and Drafters: Minimum five (5) years' experience producing Shop Drawings for architectural woodwork similar to that required for this Project.

3. Single Source Requirements: Architectural woodwork shall be supplied by one (1) fabricator.

   a. Source Limitations: Furnish Work of this Section and wood doors with matching veneer faces specified in Division 8 from same manufacturer.

B. Installer's Qualifications:

1. Experience: Minimum five (5) years installing woodwork similar in materials, construction and design to that required for this Project, and completed three (3) projects of scope, schedule and complexity similar to this Project within last two (2) years, as acceptable to Design Professional.

C. Regulatory Requirements: Comply with the indicated requirements in accordance with Division 1.

   a. Test Method: As indicated by UL or other agency acceptable to authorities having jurisdiction.
   b. Identification: Appropriate markings of agency, separable paper label or imprint on surfaces of materials that will be concealed from view after installation, as required by authorities having jurisdiction.
   c. Oversize Certification: Certify that units larger than tested assemblies are constructed exactly as tested units.

D. Referenced Codes and Standards: Comply with the following in accordance with Division 1.

1. Quality Standard: AWI's Architectural Woodwork Quality Standards

   a. Provide AWI Quality Certification Program certificate indicating that woodwork complies with requirements of grades specified.
   b. Comply with additional requirements beyond those of quality standard where indicated. Comply with such selections and requirements in addition to quality standard.

E. Preconstruction Meetings: Approximately two (2) weeks before scheduled commencement of Work, meet at Project Site to coordinate construction.

1. Attendees: Architectural Woodwork Fabricator and Installer, Installer of each component of associated Work, Installers of structure or substrate to receive woodwork, Installers of other Work that must precede or follow woodwork, Design Professional and Owner's Representative.

2. Review Foreseeable Methods and Procedures:

a. Tour areas of substrates, observe and evaluate condition of substrate, and other preparatory Work.
b. Review structural loading limitations of storage and work areas.
c. Review Contract Documents.
d. Review status of Submittals.
e. Review Construction Schedule and verify availability of materials, Installer's personnel, equipment, and facilities.
f. Review environmental conditions and procedures for correcting unfavorable conditions.
g. Review applicable AWI standards for fabrication and installation.

3. Record discussions of conference, including decisions, agreements and unresolved issues. When unresolved issues exist at conclusion of conference, determine how they will be resolved and set date for reconvening conference.

4. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

a. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
b. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, HANDLING AND STORAGE

A. Delivery: Do not deliver interior architectural woodwork until painting and similar finish operations that might damage woodwork have been completed in installation areas.

B. Storage: Store woodwork in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1. Protect from damage, moisture or other foreign matter.

2. Protect from exposed to sunlight.

3. Handle and store fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions.

1.8 FIELD CONDITIONS

A. Environmental Requirements:

1. Do not deliver or install interior architectural woodwork until building is enclosed, weathertight, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 50 percent maximum for minimum 48 hour(s) before, installation and until Date of Substantial Completion.

B. Field Measurements: Where interior architectural woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being concealed by construction, and indicate measurements on Shop Drawings.

C. Established Dimensions: Where interior architectural woodwork is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

D. Illumination: Permanent or temporary lighting providing similar intensity and color as approved by Design Professional.

Part 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Provide recycled content materials in accordance with Sustainability Action Plan specified in Sustainability Requirements: Division 1 and as indicated below.

B. Provide regional materials in accordance with Sustainability Action Plan specified in Sustainability Requirements: Division 1.

C. Provide certified wood-based materials in accordance with Sustainability Action Plan specified in Sustainability Requirements: Division 1.

D. Do not use products or adhesives that contain urea-formaldehyde resin.

E. Use adhesives and sealants that comply with the VOC limits specified in Sustainability Requirements: Division 1.

F. Use field applied paints and coatings that comply with the VOC limits and chemical restrictions specified in Sustainability Requirements: Division 1.

G. General: Comply with AWI quality standard for each type of woodwork and quality grade as specified.

H. Hardwood Veneer Panel type 1 (WD-1)

1. Wood Species and Cut for Exposed Surfaces: Maple, quarter sawn or cut. premium grade
2. Grain Matching: Run and match grain vertically and horizontally as indicated for wood veneered panels.
3. Matching of Veneer Leaves: Slip match.
4. Vertical Matching of Veneer Leaves: End match.
5. Veneer Matching within Panel Face: Running match.
6. Panel Matching Method: No matching between panels is required. Select and arrange panels for similarity of grain pattern and color between adjacent panels.
7. Vertical Panel Matching Method: End match.
8. Finish: Transparent, satin finish.

I. Panel Manufacturers: Products of the following manufacturers are acceptable, contingent on compliance with requirements:

1. Algoma Hardwoods.
2. Bookside Veneers.
3. Dooge Veneers, Inc. (Basis of Design).
4. CMI International.
5. The Collins Companies.
6. Columbia Forest Products.
7. Boise Cascade Flakeboard Company.
8. Panel Source International.
9. Roseburg Forest Products.
10. SierraPine.
11. Temple Inland Forest Products.

J. Panel Products:

1. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue with minimum 90 percent recycled and recovered wood fiber.

2. Medium Density Fiberboard (MDF): ANSI A208.2, Grade MD, exterior glue with minimum 90 percent recycled and recovered wood fiber.

K. Glass: As Specified in Glazing: Division 8.

L. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated with solid color core, or if not indicated, as required by woodwork quality standard.

1. Available Manufacturers: Products of indicated manufacturers are acceptable, contingent upon meeting indicated requirements. Equivalent products of other manufacturers will be evaluated as substitutions in accordance with requirements of Division 1.

a. Arborite; Division of ITW Canada, Inc.
b. Formica Corporation.
c. Lamin-Art, Inc.
d. Lab Designs
e. Panolam Industries International Incorporated (Nevamar).
f. Octopus products
g. Wilsonart International; Div. of Premark International, Inc.

2. Adhesive for Bonding Plastic Laminate: Nonstaining type recommended in writing by plastic laminate manufacturer and suitable for work indicated.

2.2 FIRE RETARDANT TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products according to test method indicated by a qualified testing agency.

1. Provide products with fire retardant treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use materials that are warped, discolored, or otherwise defective.

B. Fire Retardant Treated Lumber and Plywood by Pressure Process: Comply with AWPA C20 (lumber) and AWPA C27 (plywood), Type A: Low-hygroscopic interior formulation.

1. Mill lumber before treatment unless approved in writing by authority having jurisdiction. Implement procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.

2. Kiln-dry lumber and plywood before after treatment to a maximum moisture content of 19 and 15 percent, respectively or to levels required for untreated material

C. Fire Retardant Particleboard:

1. Performance: Made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture, to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less according to ASTM E 84.

2. Panels 3/4-inch-thick and less: ANSI A208.1, Grade M-2 except for the following minimum properties:

a. Density: 45 pounds per cubic feet.
b. Modulus of Rupture: 1600 psi.
c. Modulus of Elasticity: 300,000 psi.
d. Internal Bond: 80 psi.
e. Screw-holding Capacity on Face and Edge: 250 lbf and 225 lbf, respectively.

3. Panels 13/16 inch to 1 1/4 inches thick: ANSI A208.1, Grade M-1 except for the following minimum properties:

a. Density: 44 pounds per cubic feet.
b. Modulus of Rupture: 1300 psi.
c. Modulus of Elasticity: 250,000 psi.
d. Linear Expansion: 0.50 percent.
e. Screw-holding Capacity on Face and Edge: 250 lbf and 175 lbf, respectively.

D. Fire-Retardant Fiberboard:

1. Medium-density fiberboard (MDF) panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture, to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less according to ASTM E 84.

2.3 CABINET HARDWARE AND ACCESSORIES

A. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 100 degrees of opening.

B. Pulls: Standard bar pull.

C. Catches: Magnetic catches, BHMA A156.9, B03141

D. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.

E. Shelf Rests: BHMA A156.9, B04013.

F. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.

G. Concealed Hardware: Manufacturer's standard finish complying with product class requirements in BHMA A156.9.

H. Locks: Provide cabinet locks where indicated to match owner's standard.

2.4 INSTALLATION MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Fire retardant treated softwood lumber, kiln-dried to less than 15 percent moisture content.

B. Anchors and Fasteners:

1. Provide self-drilling screws for metal-framing supports, as recommended by metal-framing manufacturer.

2. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage.

3. Provide metal expansion sleeves or expansion bolts for post-installed anchors.

4. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

C. Comply with Rough Carpentry: Division 6.

2.5 ACCESSORIES

A. Concealed Steel Brackets and Metal Sub-Framing: Comply with Metal Fabrications: Division 5.

B. Ornamental Metal: Division 5.

C. Wall Panel Clips: Locking extruded aluminum "zee" type, sized for weight of panel.

2.6 FABRICATION: GENERAL

A. Woodwork Grade: AWI premium grade, unless otherwise indicated.

B. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

C. Wood Moisture Content: Comply with AWI requirements.

D. Fabricate woodwork to dimensions, profiles, and details indicated.

E. Edges of Solid Lumber: Ease to 1/16 inch radius.

F. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible, before shipment to Project Site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at Project Site, provide allowance for scribing, trimming, and fitting.

1. Notify Design Professional seven (7) days in advance of dates and times woodwork fabrication will be complete.

2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

G. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs. Seal edges of openings in countertops with a coat of varnish.

H. Work with a consistent horizontal design element, including, but not limited to, chair rail, aligned door heads, paneling and wainscots. Fabricate to allow for maximum variation of field dimensions from datum and as required to maintain finished tolerances.

I. Install glass to comply with applicable requirements in Glazing: Division 8 and in GANA's Glazing Manual. For glass in wood frames, secure glass with removable stops.

2.7 STANDING AND RUNNING TRIM

A. Quality Standard: Comply with AWI Section 300.

B. Trim Wider or Thicker than Available Lumber: Use veneered construction for transparent finish. Do not glue for width or thickness.

C. Flat Trim Members: Backout, kerf or groove backs except for members with ends exposed in Finished Work.

D. Assemble casings in plant except where limitations of access to place of installation require field assembly.

E. Assemble moldings in plant to maximum extent possible. Miter corners in plant and prepare for field assembly with bolted fittings designed to pull connections together.

1. Provide split species on trim that face areas with different wood species, matching each face of woodwork to species and cut of finish wood surfaces in areas finished.

2.8 CABINETS WITH TRANSPARENT FINISH FRONTS

A. Quality Standard: Comply with AWI Section 400 requirements for wood cabinets.

B. AWI Type of Cabinet Construction: As indicated.

C. Semi-Exposed Interior Surfaces and Shelf: High pressure decorative laminate, Grade CLS.

1. Color: White

D. Provide dust panels of 1/4 inch plywood or tempered hardboard above compartments and drawers, unless located directly under tops.

2.9 SOLID SURFACE MATERIAL COUNTERTOPS AND SHOWER CLADDING

A. Quality Standard: Comply with AWI Section 400 requirements for countertops.

B. Solid surface material thickness: ¾" for counters, ½" for shower cladding.

C. Colors, Patterns, and Finishes: As indicated on Finish Schedule on Drawings

D. Fabricate tops in (1) piece with finished edges. Comply with solid surfacing material manufacturer's recommendations for adhesives, sealers, fabrication and finishing.

E. Grain Direction: Parallel to cabinet fronts.

F. Drill holes in countertops for plumbing fittings and soap dispensers in shop.

2.10 FLUSH PLASTIC-LAMINATE PANELING

A. Quality Standard: Comply with AWI Section 400 requirements for high pressure decorative laminate paneling premium grade.

B. High-Pressure Decorative Laminate Grade: VGS.

C. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. Refer to Finish Schedule on Drawings.

D. Grain Direction: as indicated on drawings.

E. Edge Treatment: Same as laminate cladding on horizontal surfaces.

F. Core Material: Fire Retardant Particleboard. Made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture, to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less according to ASTM E 84.

G. Silicone joints to allow for expansion and contraction as main lobby ceiling trims

2.11 FLUSH WOOD PANELING

A. Quality Standard: Comply with AWI Section 500 requirements for flush wood paneling.

1. Lumber Trim and Edges: At fabricator's option, trim and edges indicated as solid wood (except moldings) may be either lumber or veneered construction compatible with grain and color of veneered panels.

B. Fire Retardant Treated Paneling: Provide panels consisting of wood veneer and fire-retardant particleboard or fire-retardant medium density fiberboard. Panels shall have flame-spread rating of 25 or less and smoke developed rating of 450 or less per ASTM E 84.

2.12 ORNAMENTAL WORK

A. Quality Standard: Comply with AWI Section 700.

2.13 SHOP FINISHING

A. Quality Standard: Comply with AWI Section 1500, unless otherwise indicated. Grade: Provide finishes of same grades as items to be finished.

B. General: Finish architectural woodwork at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

1. Comply with the Architectural Woodwork Standards for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing interior architectural woodwork, as applicable to each unit of work.

C. General: Entire finish of interior architectural woodwork is specified in this Section, regardless of whether shop applied or applied after installation. Extent to which final finish is applied at fabrication shop is Contractor's option, except shop apply at least prime coat before delivery.

D. General: Shop finish transparent finished interior architectural woodwork at fabrication shop as specified in this Section. Refer to Painting: Division 9 for finishing opaque finished architectural woodwork.

E. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of Work.

1. Backpriming: Apply one (1) coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two (2) coats to back of paneling and to end grain surfaces. Concealed surfaces of plastic laminate-clad woodwork do not require backpriming when surfaced with plastic laminate, backing paper, or thermoset decorative overlay.

F. Transparent Finish: Comply with requirements indicated below for, finish system, staining, and sheen, with sheen measured on 60 degree gloss meter per ASTM D 523:

1. AWI Finish System TR-2: Catalyzed lacquer.

2. Staining: Match Design Professional's Sample.

3. Wash Coat for Stained Finish: Apply a vinyl wash coat to woodwork made from closed grain wood before staining and finishing.

4. Open Finish for Open Grain Woods: Do not apply filler to open grain woods.

5. Filled Finish for Open Grain Woods: After staining (if any), apply paste wood filler to open-grain woods and wipe off excess. Tint filler to match stained wood.

a. Apply vinyl wash coat sealer after staining and before filling.

6. Sheen: Satin, 30-50 gloss units. gloss units measured on 60-degree gloss meter according to ASTM D 523.

Part 3 EXECUTION

3.1 EXAMINATION

A. Project Site Verification of Conditions:

1. Substrates: Examine for conformance to requirements indicated for that substrate.

B. Testing: Test plaster, concrete, CMU and other masonry substrates for moisture content.

C. Conditions: Report to Contractor prior to commencing Work.

D. Corrections: Perform corrections as directed by Contractor or Owner's Representative.

E. Acceptance: Commencing installation constitutes acceptance of substrate as suitable. Provide Work required because of installation over deficient or defective substrates at no additional cost.

3.2 PREPARATION

A. Before installation, condition interior architectural woodwork to humidity conditions in installation areas for not less than 72 hours prior to beginning of installation.

B. Before installing interior architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming of concealed surfaces.

C. Condition woodwork to average prevailing Relative Humidity conditions in installation areas before installation.

D. Surface Preparation: Prepare surfaces as required to:

1. Make substrates ready for application of finish or system.

2. Make substrate suitable to provide Finished Work complying with indicated criteria and matching approved Samples.

E. Layout: For work with a consistent horizontal design element, including, but not limited to, chair rail, aligned door heads, paneling and wainscots, establish a datum line extending throughout extent of Work.

1. Datum shall be within tolerances listed for Finished Work.

2. Datum shall be used to establish field measurements for Shop Drawings and production.

3.3 INSTALLATION

A. Grade: Install woodwork to comply with AWI Section 1700 for same grade indicated in this Section for type of woodwork involved.

B. Assemble interior architectural woodwork and complete fabrication at Project site to the extent that it was not completed during shop fabrication.

C. Install woodwork level, plumb, true, and straight and without distortion.

1. Shim as required with concealed shims.

2. Install level and plumb to a tolerance of 1/8 inch in 96 inches

D. Scribe and cut woodwork to fit adjoining work and refinish cut surfaces and repair damaged finish at cuts.

E. Fire Retardant Treated Wood: Handle, store, and install fire retardant treated wood to comply with written recommendations of chemical treatment manufacturer, including those for adhesives used to install woodwork.

1. Where cut or drilled in field, treat cut ends and drilled holes according to AWPA M4.

F. Anchor interior architectural woodwork to anchors or blocking built in or directly attached to substrates.

1. Secure with countersunk and plugged fasteners, concealed fasteners or blind nailing.

2. Where allowed by AWI grade, use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork and matching final finish.

3. For shop-finished items, use filler matching finish of items being installed.

G. Work with a consistent horizontal design element, including, but not limited to, chair rail, aligned door heads, paneling and wainscots.

1. Install work in relationship to datum line indicated on Shop Drawings.

2. Trim or scribe each element of woodwork to adjacent construction to maintain alignment of horizontal design element.

H. Standing and Running Trim: Install with minimum number of joints possible, using full length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 96 inches long, except where substrate is shorter.

1. Scarf running joints and stagger in adjacent and related members unless doweled, biscuit or splined joints are allowed by Design Professional.

2. Transparent Finish:

   a. Scribe premium grade work to substrates for hairline joint without use of fillers or sealants.
   b. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as trim, if finished. Do not use sealant to fill gaps.

3. Opaque Finish: Fill gaps, if any, with paintable sealant specified in Joint Sealants: Division 7.

4. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches

I. Cabinets: Install without distortion so doors and drawers are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items.

1. Maintain veneer sequence matching of cabinets with transparent finish.

2. Fasten wall cabinets through back, near top and bottom, within 2 inches of ends and not more than 16 inches on center.

   a. Use No. 10 wafer head screws, sized for 1-inch penetration into wood framing, blocking, or hanging strips or toggle bolts.
   b. Conceal fasteners at open Premium Grade cabinets.

J. Countertops: Screw through corner blocks of base cabinets or other supports into underside of countertop.

K. Paneling: Anchor paneling to supporting substrate with concealed panel-hanger clips. Do not use face fastening, unless or otherwise indicated.

L. Complete finishing Work specified in this Section to extent not completed at shop or before installation of woodwork. Fill nail holes with matching filler where exposed. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats were applied in shop.

M. Finishes: Refer to Division 9 Sections for final finishing of installed architectural woodwork.

3.4 FIELD QUALITY CONTROL

A. Tolerances:

1. General: Comply with more stringent tolerances than those listed below if required to:

   a. Match approved Field Sample.
   b. Align with other adjacent Work with more stringent tolerances.

2. Reference Standards: Comply with tolerances listed in AWI, Section 1700 except where more stringent requirements are indicated.

3. Level and Plumb: Maximum 1/8-inch deviation in 96 inches.

4. Line and Location: Maximum 1/8 inch deviation from ideal location or straight line in any 96 inches .

5. Variation of Gaps or Reveals:

   a. Widths less than 1/4 inch: Plus or minus maximum 1/32 inch .
   b. Widths more than 1/4 inch and less than 3/4 inch : Plus or minus maximum 1/16 inch .
   c. Widths 3/4 inch and wider: Plus, or minus 1/8 inch.

3.5 REPAIR

A. Repair damaged and defective interior architectural woodwork, where possible, to eliminate functional and visual defects and to result in interior architectural woodwork being in compliance with requirements of Architectural Woodwork Standards for the specified grade.

B. Where not possible to repair, replace defective woodwork.

C. Shop Finish: Touch up finishing work specified in this Section after installation of interior architectural woodwork.

1. Fill nail holes with matching filler where exposed.

2. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are shop applied.

3.6 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semi exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas as approved by Owner's Representative.

END OF SECTION 064023

SECTION 070500 EXTERIOR ENCLOSURE GENERAL

PART 1 GENERAL

1.1 RELATED DOCUMENTS SPECIFIED ELSEWHERE (NON-INCLUSIVE)

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Applicable Sections: Division 1.

C. Inspection and Testing of Roofing: Division 1.

D. Inspection and Testing of Exterior Enclosure: Division 1.

E. Technical Specification Sections for each component of exterior enclosure.

1.2 SUMMARY (NON-INCLUSIVE)

A. Section Includes: Administrative procedures, criteria, inspection and testing and supporting work required for construction of exterior enclosure in compliance with design intent and specified criteria as follows:

1. Coordination of Exterior Enclosure Drawings.
2. Structural Criteria.
3. Mock-ups.

1.3 SUBMITTALS

A. Submit per the requirement of Division 1.

B. Shop Drawings:

1. Show fabrication and installation details for mock-up. Include materials, dimensions, gauges, trim, fasteners, closures and finishing including all attachments to surrounding construction. Show how system complies with specified criteria including, but not limited to, accommodation of structural movement, thermal cycling and control of water penetration.

   a. Elevations: Minimum 1/4-inch equals 1-foot scale elevation of each area of curtainwall.
   b. Details: Minimum 3 inches equals 1-foot scale details of each assembly including heads, sills, mullions, corners, intersection with abutting construction and joints in system.
   c. Coordination Drawings: As indicated.
   d. Tolerance Diagram: As indicated.

C. Product Data: Manufacturer's printed specifications for materials and fabrication and installation instructions.

D. Calculations: As indicated.

E. Quality Control Procedures: Test Reports showing compliance with specified criteria.

F. Certifications: As indicated.

1. Coordination.
2. Glass.

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1.4 DEFINITIONS

A. Exterior rainscreen system is defined as all of elements required to maintain building watertight; to moderate interior to exterior temperature, humidity, and vapor pressure; to secure interior occupants and materials from exterior and other functions describe herein. Extent of exterior enclosure is indicated on Drawings and includes, but not limited to, the following:

1. Foundations and slabs-on-grade.
2. Exterior walls, curtainwalls and window walls.
3. Air / Vapor barrier.
4. Exterior doors and windows.
5. Roofing.
6. Structural elements required to support enclosure.
7. Anchors, inserts, brackets, clips and braces required to attach enclosure to structural elements.
8. Sealants, joint fillers, joint covers, gaskets, vents, weeps, flashing and trim required to close gaps in enclosure.
9. Firesafing required to close gaps between enclosure and other elements and to seal penetrations in fire rated elements of enclosure.

B. Water penetration is defined as appearance of uncontrolled water on an interior surface of any part of Work. "Controlled" water or condensation is that which is demonstrably drained harmlessly to exterior of Work without endangering or wetting adjacent surfaces and not visible in final construction.

1.5 SYSTEM REQUIREMENTS

A. Performance Requirements: Conform to the following requirements for design and engineering and when individual Specification Sections refer to this Specification Section.

B. Air Requirements: Air barrier shall be capable of performing as a continuous vapor-retarding air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

1. Materials used for the air barrier system in the opaque envelope shall have an air permeance not to exceed 0.004 cfm/ft2 under a pressure differential of 1.57psf when tested in accordance with ASTM E 2178.
2. Limit air leakage through fenestration and insulated metal panel assemblies to [0.06 cfm per square foot] of wall area, measured at a reference differential pressure across assembly of 6.24 psf when tested ASTM E 283
    a. Air leakage shall not exceed [1.0 cfm per square foot] for glazed swinging entrance doors.
3. The air leakage of the entire building shall not exceed [0.15 cfm/ft2] under a pressure differential of [1.57psf] when tested according to ASTM E 779.

C. Water Requirements: Document conformance with the following criteria through independent Testing provided by manufacturer on systems substantially identical to system proposed for this Project. Manufacturer may use previous tests if suitable and current. If previous tests are unsuitable, provide test per referenced standard.

1. Water Penetration under differential pressure: No uncontrolled penetration shall occur when the exterior wall is tested in accordance with ASTM E 331 using [5.0 gal/ft2/hr] of water for 15 minutes.

2. Water penetration under dynamic conditions: No uncontrolled water penetration through curtainwall system when tested per AAMA 501/501.1.

3. Minimum pressure for water penetration tests shall be the greater of 12 psf or 20 percent of the minimum design wind pressure specified below.

D. Thermal Movement: Provide for expansion and contraction of component materials, as caused by an exterior ambient temperature ranging from minus 5 degrees F to a surface temperature of 180 degrees F, an interior temperature range of plus 50 degrees F to plus 100 degrees F, and an interior to exterior differential of 100 degrees F without causing buckling, excessive stresses, failure of joint seals, undue stress on structural elements, damaging loads on fasteners, reduction of performance, other detrimental effects or excessive condensation.

1. Show amount of accommodated thermal movement in Shop Drawings and provide thermal calculations.

2. Identify assumed temperature at fabrication versus temperature at installation and how design compensates.

3. Show how thermal movement of interconnected systems is accommodated.

4. Manufacture shall certify that thermal movement will not cause undo pressure in glass.

E. Movement of Structure: Accommodate the following structure movements:

1. Floor-To-Floor Differential Movements: Plus or minus 1/2 inch vertically.

2. Lateral Racking: 1/2 inch per floor.

3. Show amount of movement accommodated on Shop Drawings.

F. Design Loads:

1. Dead Loads: Self-weight of elements and attached finishes.

2. Roof Loads: As indicated on Drawings, 30 psf exclusive of dead loads and snow loads.

3. Minimum design wind pressures acting normal to the surface of Work shall be as follows for tributary areas of 50 square feet. Pressures for different tributary areas shall be calculated in accordance with IBC 2015.

a. Walls:

1) Walls within 12'-6" feetof a corner: 33 psfinward, 40 psf outward.

2) All other wall regions: 33 psf inward, 35 psfoutward.

b. Roofs:

1) Roofs within 12'-6" feet of roof edge and greater than 12'-6" of a corner: 32 psf inward, 49 psf outward.

2) Roofs within 12'-6" feet of roof edge and of a corner: 32 psf inward, 49 psf outward.

3) All Other Roof Areas: 16 psf inward, 36 psf outward.

4. Seismic Loads:

a. Seismic forces shall be determined in accordance with IBC 2018 (ASCE 7-10) and seismic criteria listed on Structural Drawings, and applied at centers of gravity of elements and distributed relative to the distribution of mass.

G. Structural Requirements at Design Load:

1. Deflection of framing members in a direction normal to plane of wall when subjected to design loads shall not exceed the lesser of L/360 (L is the clear span of the member) or 1 inchexcept as follows:

a. Cantilever Deflection: Where framing members overhang an anchor point the member span (L) used to determine the maximum allowable deflection may be considered to be two times the actual span.

b. Metal Panels and Gypsum Drywall Construction: Limit deflection of members supporting metal panels and gypsum drywall construction to L/240.

c. Glass: Limit deflection of framing members supporting glass to the following:

2. L/175 for spans up to 13 feet 6 inches and L/240 plus [1/4 inch] for spans greater than 13 feet 6 inches

3. The deflection of the edge of each individual pane of glass shall not exceed the lesser of L/175 (L is the glass edge length) or [3/4 inch]

4. Deflection of framing members parallel to plane of wall when subject to design loads shall not exceed the lesser of L/360 (L is the clear span of the member) or 3/4 inchexcept as follows:

a. Cantilever Deflection: Where framing members overhang an anchor point the member span (L) used to determine the maximum allowable deflection may be considered to be two times the actual span.

b. Members Supporting Glazing: Limit deflection to the following:

1) An amount which reduces glazing bite to less than 75 percent of design dimension.

2) An amount which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch }.

3) Deflection shall not impair function of or damage any joint seals when deflected.

5. Deflection of panels and glazing normal to plane of wall when subject to design loads shall not exceed the following:

a. Sheet, Plate, Brake Metal, Composite Materials or other similar exposed metal or metal clad panel surfaces: Limit deflection normal to its plane at full design load to lesser of L/180 (L is the least face dimension) or a lesser amount as required to eliminate oil canning visible from more than 3 feet under any lighting conditions.

b. Glazing: Limit center of glass deflection normal to its plane at full design load to lesser of L/100 (L is the least edge dimension) or 3/4 inch. Manufacturer shall certify that design deflection does not cause undue pressure in glass as placed and designed.

6. Limit deflection as required to not adversely affect performance for water penetration, air leakage and other similar specified criteria.

7. Where various exterior enclosure systems are interconnected, design all systems for the most restrictive individual system deflection criteria or provide for adequate flexibility within the connections to allow differential deflection without adversely affecting any of the connected systems.

8. Stresses shall not exceed allowable values established by applicable Codes and Specifications.

9. Glass, sealants, and interior finishes, including gypsum wallboard, shall not be assumed to contribute to framing member strength, stiffness, or lateral stability.

10. Compression flanges of flexural members may be assumed to receive effective lateral bracing only from members in actual contact with compression flange and adequately anchored to building structure. Points of contraflexure shall not be regarded as lateral braces or as end points of an unbraced length; unbraced length shall be the actual distance between effective lateral braces as defined above.

1.6 QUALITY ASSURANCE

A. Field Mock-up: Construct in-situ mock-up as follows:

1. Extent: Erect a selected portion of the exterior enclosure of the building as indicated on the drawings or in a location to be designated by Contractor and approved by the owner and architect. When approved, Project field mock-up will remain in place as part of Finished Work. If rejected, repair, replace components, or rebuild until approval of field mock-up is achieved. Do not begin installation until Field Mock-up is approved.

2. Intent: Field Mock-up shall establish acceptable levels of craftsmanship, quality and appearance.

3. Location: Built-into Work for inclusion in final Project. On Project Site at location directed by Contractor.

4. Submittals: Obtain approvals of submittals prior to construction of mock-up.

5. Obtain Design Professional's acceptance of mock-up. Revise, repair, replace or rebuild mock-up as required to meet design intent and specified performance.

6. Construction Photographs: Document entire construction of mock-up with photographs taken at a rate of approximately 24 per eight-hour workday. Pay particular attention to details and difficult assemblies.

B. Coordination: Contractor shall coordinate Work specified in individual Specification Sections that is required to complete exterior enclosure.

1. Coordination Drawings: Prepare and submit for approval Coordination Drawings wherever submittals required in individual Specification Sections do not adequately describe how finished Work is to be coordinated. Mock-up Drawings may be used for Coordination Drawings to extent of situations covered, but additional Coordination Drawings shall be provided as required. Coordination Drawings shall include, but not limited to, the following:

   a. Continuity Details: Show how provisions for control of water and vapor penetration are maintained across, for example, multiple materials, assemblies and systems.
   b. Show exact relationships of elements.
   c. Show method of support or anchorage.
   d. Show loads imposed on one element by another.

2. Tolerance Diagram: Single line plans, sections and elevations indicating maximum allowable deviations from design location for structure and enclosure. Use diagram to verify required space for adjustment in installing enclosure.

3. Certifications: Submit certification from all manufacturers involved for appropriateness and compatibility of their products for uses indicated. Certifications shall address, but not be limited to, the following criteria:

   a. Compatibility of materials and product which are in contact.
   b. Isolation of dissimilar metals to avoid electrolytic action.
   c. Compatibility of adhesives with substrates.
   d. Compatibility of sealants with substrates.
   e. Compatibility of sealants with other sealants which may come into contact.

C. Coordination Meeting: Convene a meeting to coordinate Work related to exterior enclosure.

1. Schedule meeting prior to submittals for any significant portion of exterior enclosure.

2. Location of Meeting: Project Field Office of Contractor.

   a. Conduct meeting per requirements of Division 1.
   b. Notify Owner's Representative and Design Professional minimum one week in advance.

3. Attendance:

   a. Owner's Representative.
   b. Design Professional's Representative.
   c. Contractor's Representative.
   d. Subcontractors and installers of exterior enclosure work.
   e. Subcontractors and installers of substrates to which exterior enclosure work is applied.
   f. Suppliers of materials for exterior enclosure work.
   g. Manufacturer's Technical Representatives for exterior enclosure work as indicated in individual Specification Sections.
   h. Others as appropriate.

4. Suggested Agenda related to exterior enclosure:

   a. Review requirements of Drawings and Specifications related to exterior enclosure.
   b. Review of progress of Submittals.
   c. Field observations, problems, conflicts anticipated.
   d. Review of off Project Site fabrication, Delivery Schedules.

e. Coordination of schedules, deliveries and long lead items.
f. Review and coordinate interface of different systems.
g. Review and coordinate relationship of tolerances of different systems.
h. Maintenance of quality standards.
i. Review effect on portions of Work.
j. Other business.

D. Exterior Enclosure Erection Plan: Prepare a plan describing means and methods to erect the exterior enclosure. Include the following:

1. Means and methods to accommodate expansion and contraction of structural frame from time of erection until operation of permanent HVAC system.
2. Means and methods to maintain specified tolerances for exterior enclosure Work accounting for movement and deflection of structural frame.
3. Sequencing and Scheduling.
4. Periodically survey, minimum once per week, the structural steel to anticipate means and methods required at time of erection of exterior enclosure.

E. Preinstallation Meeting: Prior to start of Work for any individual product or system, Contractor shall hold a Preinstallation Meeting with all concerned parties, including parties who will later incorporate new Work into Work for which Preinstallation Meeting is held.

1. Conduct meeting per requirements of Division 1.
2. Notify Owner's Representative and Design Professional minimum one week in advance.
3. Hold a Preinstallation Meeting prior to starting mock-up work.

1.7 SCHEDULING

A. Schedule Work to allow for:

1. Construction of mock-up.
2. Modifications of mock-up.
3. Approval of mock-up.
4. Submittals, resubmittals and approval of required data.
5. Submittals, resubmittals and approval of coordination data.

B. Submittals for Work which is contained within the mock-up will not be reviewed prior to approval of mock-up.

Part 2 PRODUCTS

2.1 MATERIALS

A. Materials, products, equipment, systems, accessories for mock-up shall match materials, products, equipment, systems, accessories specified for Final Work.

Part 3 EXECUTION

3.1 PREPARATION FOR MOCK-UP

A. Prepare Project Site for mock-up by stripping topsoil, grading and excavating, including environmental protection measures per Division 1.

3.2 ERECTION OF MOCK-UP

A. Erect mock-up per approved submittals.

B. Notify Owner and Contractor minimum one week in advance of start of Work on mock-up and minimum 48 hours in advance of commencing Work on any important or large component of mock-up.

3.3 INSPECTION MOCK-UP

A. Coordinate and cooperate with independent Inspection and Testing Agency.

END OF SECTION 070500

SECTION 07 14 00
FLUID-APPLIED WATERPROOFING

PART 1 GENERAL

1.1 SUMMARY

A. Provide fluid-applied membrane waterproofing.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Warranty: Submit manufacturers standard warranty. Include labor and materials to repair or replace defective materials.
   1. Warranty Period: 5 years for polyurethane waterproofing.
   2. Warranty Period: 10 years for hot rubberized waterproofing.

1.3 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 MATERIALS

A. Foundation Wall Waterproofing:
   1. Manufacturers: Cetco
   2. Type: One-part modified polyurethane-based liquid membrane waterproofing, 90 percent solids, ASTM C 836, 60 mil thick coating.
   3. Accessories: Primers, surface conditioners, termination bars, and protection board.

PART 3 EXECUTION

3.1 INSTALLATION

A. Modified Polyurethane Waterproofing: Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction. Coordinate with work of other sections.

B. Restore damaged components and test waterproofing. Clean and protect work from damage.

END OF SECTION

SECTION 072100 THERMAL INSULATION

Part 1 GENERAL

1.1 RELATED DOCUMENTS SPECIFIED ELSEWHERE (NON-INCLUSIVE)

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Applicable Sections: Division 1.

C. Cold-Formed Metal Framing (CFMF): Division 5.

D. Precast Structural Concrete: Division 5.

E. Sheathing: Division 6.

F. Air / Vapor Barriers: Division 7.

G. Roofing: Division 7, refer to for roof and deck insulation.

H. Gypsum Wallboard Assemblies: Division 9, refer to for sound attenuation insulation and metal framing for gypsum wallboard.

I. Mechanical: Division 23, refer to for insulation of mechanical systems

1.2 SUMMARY (NON-INCLUSIVE)

A. Section Includes: Thermal insulation for the following applications:

1. Foundation wall insulation supporting backfill.
2. Exterior Wall and Curtainwall insulation, semi-rigid.
3. Insulation associated with firestopping system.
4. Board-type, and loose glass fiber building insulation not specified in other Sections

1.3 SUBMITTALS

A. Submit per requirements of Division 1.

B. Product Data: For each component or material required including accessories, anchors, and other miscellaneous products.

C. Sustainability Submittals: Provide the following in accordance with Sustainability Requirements: Division 1.

1. Materials Sustainability Documentation Form.
2. Product data, certification letter, and costs for materials with recycled content.
3. Product data and costs for regional materials.
4. Product data for adhesives and sealants indicating VOC content.
5. Product data for paints and coatings indicating VOC content and chemical composition.

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1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of building insulation through one (1) source.

B. Fire-Test-Response Characteristics: Provide insulation and related materials with fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another Inspection and Testing Agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable Inspection and Testing Agency.

1. Surface-Burning Characteristics: ASTM E 84.
2. Fire-Resistance Ratings: ASTM E 119.
3. Combustion Characteristics: ASTM E 136.

1.5 DELIVERY, HANDLING AND STORAGE

A. Comply with manufacturer's written recommendations,

B. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Do not allow insulation to become wet or damp. Comply with manufacturer's written instructions for handling, storing, including recommendations for temperature and humidity range and protecting during installation.

Part 2 PRODUCTS

2.1 GENERAL

A. Provide recycled content materials in accordance with Sustainability Action Plan specified in Sustainability Requirements: Division 1 and as indicated below.

B. Do not use products or adhesives that contain urea-formaldehyde resin.

C. Use adhesives and sealants that comply with the VOC limits specified in Sustainability Requirements: Division 1.

D. Insulation shall not be produced with or contain any U.S. EPA regulated CFC Compounds listed in Montreal Protocol.

2.2 RIGID INSULATION

A. Polystyrene: ASTM C 578, extruded only except where expanded polystyrene is indicated, of type indicated.

1. Vertical Below Grade Applications: Type VI.
2. Horizontal Below Slab Applications: Type IV.
3. All Other Applications, Unless Otherwise Indicated: Type IV.
4. Thermal Conductivity: 5-year aged R-value of 25 and 6 per inch at 40 degrees F and 75 degrees F respectively.
5. Surface Burning Characteristics: Maximum Flame spread of 25 and smoke developed of 450 per ASTM E 84.
6. Edge Shape: Square.
7. HCFC Content: None.
8. Recycled Content: 15 percent minimum.

2.3 SEMI-RIGID INSULATION

A. Mineral Fiber Insulation: Semi-rigid boards complying with ASTM C 612, Type 4B by Fibrex, Roxul, Thermafiber, or approved equivalent.

B. Exterior Cavity Walls:

1. Fiber Type: Manufactured from Slag, glass fiber not acceptable.
2. Thickness: As required to achieve indicated R-value, thickness as indicated on drawings.
3. Surface Burning Characteristics:
   a. Unfaced: Maximum flame spread 0 and smoke developed of 0 per ASTM E 84.
   b. Faced: Maximum flame spread 25 and smoke developed of 50 per ASTM E 84.
4. Facing: Foil faced as indicated; unfaced for other applications.
5. Recycled Content: 75 percent minimum.

C. Fire Barrier Walls:

1. Fiber Type: Manufactured from Slag, glass fiber not acceptable.
2. Thickness: As required to achieve indicated R-value, thickness as indicated on drawings.
3. Surface Burning Characteristics:
   a. Unfaced: Maximum flame spread 0 and smoke developed of 0 per ASTM E 84.
   b. Faced: Maximum flame spread 25 and smoke developed of 50 per ASTM E 84.
4. Facing: Unfaced.
5. Recycled Content: 75 percent minimum.

2.4 BATT INSULATION

A. Mineral Fiber Insulation: Mineral fiber batt insulation complying with ASTM C 665, Type iii by Fibrex, Roxul, Thermafiber, or approved equivalent.

1. Fiber Type: Manufactured from Slag, glass fiber not acceptable.
2. Thickness: As indicated on drawings or to fill stud cavity.
3. Surface Burning Characteristics:
   a. Unfaced: Maximum flame spread 0 and smoke developed of 0 per ASTM E 84.
   b. Faced: Maximum flame spread 25 and smoke developed of 50 per ASTM E 84.
4. Recycled Content: 70 percent minimum.

2.5 LOOSE GLASS FIBER INSULATION

A. Glass fibers processed to comply with ASTM C 764, Type 2 for poured application; passing ASTM E 136 for combustion characteristics; maximum flame spread, and smoke developed values of 5 and 5, respectively.

B. Recycled Content: 20 percent minimum.

2.6 FOAMED-IN-PLACE INSULATION

A. Materials: Low-expansion, water-cure, closed-cell polyurethane foam containing no formaldehyde, CFCs or HCFCs.

B. Thermal Resistance: R6 per inch.

C. Water Vapor Permeance: 1.82 per inch according to ASTM E96.

D. Burn Characteristics: ASTM E 84 at 2 inches, flame spread less than 25, smoke development less than 350.

E. Acceptable Products:

1. SuperGreen Foam, by Foam-Tech, Div. of H.C. Fennell.
2. Walltite by BASF.

2.7 AUXILIARY MATERIALS

A. Adhesive: Type recommended in writing by insulation manufacturer and compatible with sealing mastic. Fluid-applied Air/Vapor Retarder specified elsewhere in Division 7.

B. Rigid Insulation Sealing Mastic: Henry Bakor Air-Bloc 21 or 230-21 or use insulation adhesive if acceptable to adhesive manufacturer.

C. Rigid Insulation Joint Sealant:

1. Great Stuff Pro by Dow Chemical Company.
2. Pur Fill 1G by Todol Products.
3. Zerodraft Foam Sealant by the Zerodraft Division of Canam Building Envelope Specialists.

D. Furring: Refer to Gypsum Wallboard Assemblies: Division 9.

E. Mechanical Anchors: Type and size as recommended in writing by insulation manufacturer for type of application and condition of substrate.

F. Tape: As recommended in writing by insulation manufacturer for maintaining continuity of vapor retarder.

Part 3 EXECUTION

3.1 EXAMINATION

A. Project Site Verification of Conditions:

1. Examine substrates to which insulation shall be applied for suitability and conformance to specified tolerances.
2. Report deficiencies to Contractor prior to commencing Work.
3. Commencing Work constitutes acceptance of substrate. Perform future work required because of deficient substrates no additional cost.

3.2 PREPARATION

A. Clean substrates of substances harmful to adhesives, insulations or facings. Remove projections that might puncture insulation or vapor retarders, or that interfere with insulation attachment.

3.3 INSTALLATION

A. Comply with manufacturer's written instructions for each condition.

B. Extend insulation full thickness as indicated over entire area to be insulated.

C. Apply insulation in single thickness, unless otherwise indicated or unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

D. Cut insulation with a saw, knife or other sharp tool, to fit snugly around obstructions including vents, pipe and conduit. Butt boards tightly together.

E. Faced Insulation:

1. Set vapor retarder faced units with vapor retarder to artificially heated side of construction.

2. Install vapor retarder per approved submittals and additional written instructions from manufacturer as required.

3. Coordinate installation with supplemental vapor retarder materials specified in Air/Vapor Barriers: Division 7.

4. Vapor retarder shall form a continuous envelope around conditioned spaces.

   a. Seal perimeter of each type of vapor retarder to adjacent vapor retarder or to intervening vapor impermeable materials.
   b. Seal all penetrations to vapor impermeable materials.
   c. Vapor impermeable materials shall be metal or other materials with a perm rating of less than one (1).
   d. When sealing vapor retarders to other vapor impermeable materials, seal joints in vapor impermeable material using mastics, sealants, tapes and sheets as recommended in writing by manufacturer.

3.4 INSTALLATION OF RIGID INSULATION

A. Perimeter Foundation Insulation:

1. Foundation Walls:

   a. Apply insulation board directly to damp proofing at foundation walls. Hold in place until backfilled.
   b. Extend board from underside of floor slab to minimum 24 inches below final exterior grade, unless otherwise indicated.

3.5 INSTALLATION OF SEMI-RIGID INSULATION

A. Exterior Wall Insulation: Apply insulation board with adhesive, using either spot or ribbon method except when insulation is retained by metal clips supporting metal panels.

1. Install insulation within cavity space tightly against back-up wall.

2. Secure insulation in place with "Z" furring strip and adhesive.

3.6 INSTALLATION OF LOOSE INSULATION

A. Stuff loose glass fiber insulation into miscellaneous voids and cavity spaces where insulation is indicated and where board or blanket/batt type cannot be properly fitted. Compact to approximately 40 percent of normal maximum volume to produce a density of approximately [2.5 pounds] {40 kg/cu m} per cubic foot.

3.7 INSTALLATION OF FOAMED-IN-PLACE AND SPRAY-APPLIED INSULATION

A. Apply foamed-in-place and spray-applied insulation according to manufacturer's written instructions. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied, make it even with studs by using method recommended by insulation manufacturer.

1. For cellulosic insulation, comply with the Cellulose Insulation Manufacturers Association's (CIMA) Technical Bulletins and Updates.

3.8 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

SECTION 072500 AIR AND VAPOR BARRIER

Part 1 GENERAL

1.1 RELATED DOCUMENTS SPECIFIED ELSEWHERE (NON-INCLUSIVE)

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Applicable Sections: Division 1.

C. Cold-Formed Metal Framing (CFMF): Division 5.

D. Sheathing: Division 6.

E. Exterior Enclosure, General: Division 7.

F. Building Insulation: Division 7.

G. Flashing and Sheet Metal: Division 7.

H. Aluminum Entrances and Storefronts: Division 8.

I. Aluminum Curtainwall: Division 8.

J. Gypsum Wallboard Assemblies: Division 9.

1.2 SUMMARY (NON-INCLUSIVE)

A. Section Includes:

1. Membranes and accessories required for controlling air and water penetration in exterior walls, parapets, soffits and where otherwise indicated.

2. Materials and installation to bridge and seal all air leakage pathways and gaps in the exterior enclosure, including but not limited to the following:

   a. Connections of the wall to the roof air/vapor barrier.
   b. Connections of the wall to foundation air/vapor barriers.
   c. Control joints, expansion joints, and other joints in the building to accommodate movement.
   d. Joints between wall assemblies and frames for windows, doors, storefront and curtainwall.
   e. Joints between various wall assemblies.
   f. Piping, conduit, duct and similar penetrations.
   g. Ties, screws, anchors, bolts, attachment plates, and similar penetrations.

1.3 SUBMITTALS

A. Submit per the requirements of Division 1.

B. Shop Drawings: Show location and extent of air barrier and details of joints, intersections, transitions, and bridging of gaps. Show provisions for conformance with indicated criteria.

1. Conform with requirements for Coordination Drawings showing continuity of air/vapor barrier per Exterior Enclosure, General: Division 7.

2. Plans and Elevations: Minimum 1/4-inch equals 1 foot {1:50} scale.

3. Details: Minimum 3-inch equals 1 foot {1:5} scale. Show each layer of material required.

C. Product Data: For each component or material required, including accessories, anchors, and other miscellaneous products, also include written installation instructions.

D. Manufacturer's test data for ASTM E84.

E. Manufacturers list and description of wall assemblies, incorporating product, approved per NFPA 285.

F. Qualifications: Manufacturer's and Installer's qualification data.

G. Quality Control Procedures: Show compliance with indicated criteria.

1. Quality Control Plan.
2. Substrate Acceptance Letters.
3. Field Test Procedures.
4. Daily Field Inspection and Test Reports: Within one (1) day after inspection.
5. Manufacturer's Field Reports: Within one (1) week after inspection.

H. Certifications: Written certification letters where indicated.

I. Sustainability Submittals: Provide the following in accordance with Sustainability Requirements: Division 1.

1. Materials Sustainability Documentation Form.
2. Product data, certification letter, and costs for materials with recycled content.
3. Product data and costs for regional materials.
4. Product data for adhesives and sealants indicating VOC content.
5. Product data for paints and coatings indicating VOC content and chemical composition.

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1.4 QUALITY ASSURANCE

A. Manufacturer's Qualification: Manufacturer shall have minimum five (5) years' experience producing products similar to those required for this Project. Manufacturer shall have documented experience of successfully providing products for three (3) Projects of scope, schedule and complexity similar to this Project within last two (2) years.

1. Company marketing primary products specified for this Section shall also be manufacturer. Companies marketing products which are manufactured by third parties for private labeling by marketing company will not be allowed.

B. Installer's Qualifications: Installers shall be officially recognized during bidding and installation as a Licensed Contractor by the Air Barrier Association of America (ABAA).

C. Installer's Qualifications: Installers shall demonstrate sufficient qualifications as acceptable to Design Professional, including but not limited to the following:

1. Installer shall have minimum five (5) years' experience installing products similar to those required for this Project.
2. Installer shall have documented experience of successfully completing three (3) Projects of scope, schedule and complexity similar to this Project within last two (2) years. Submit qualifications on Installer's letterhead. Include project descriptions with Owner and Design Professional contacts for previous experience.

D. Single Source Requirements: Primary products required for Work of this Section shall be supplied by one (1) manufacturer. Accessory products including, for example, fasteners, sealants and anchors may be from other than primary manufacturer if approved in writing by primary manufacturer.

E. Regulatory Requirements: Comply with combustibility rating for exposed materials as required by building codes in accordance with Division 1.

F. Referenced Codes and Standards: Comply with the following in accordance with Division 1.

1. Sealant, Waterproofing and Restoration Institute (SWRI)

Sealant and Caulking Guide Specifications

G. Certifications: Manufacturer shall certify in writing the following:

1. Use and Compatibility Certification: Certify that materials are appropriate for indicated use and that substrates and adjacent materials are compatible.

2. Certify installer qualifications.

3. Certify single source responsibility.

4. Certify acceptance of products manufactured by Others.

H. Mock-ups: Provide air/vapor barrier materials required for mock-up specified in Exterior Enclosure, General: Division 7.

I. Field Quality Assurance: Implement the ABAA Quality Assurance Program requirements. Cooperate with ABAA inspectors.

J. Installer's Quality Control Program: Installer shall establish a quality control program to ensure compliance with requirements. Submit plan for approval by Design Professional. Installer's existing quality control program may be acceptable if all requirements listed below are met.

1. Document each aspect of quality control plan, including statistical data regarding compliance to tolerances. Plan shall include names of approved inspectors who shall initial each quality control inspection or check. Include qualifications of inspectors.

2. Program shall include procedures which provide for the following:

a. Installers inspection and checking at each phase of Work including, but not limited to, checking of the following to assure compliance with Contract Documents, submittals and as required to match approved Samples and Shop Drawings.

1) Raw materials upon delivery.

2) Shipping, storage and handling of raw materials.

3) Substrates and structures to which air/vapor barrier is installed.

4) Each phase of installation.

b. Substrate Acceptance Letters: At start of installation or each portion thereof, Installers shall examine substrate and adjacent construction and certify acceptance as indicated.

c. Daily Field Inspection and Test Reports: Prepare a detailed report for each day air/vapor barrier work is being installed on Project Site, describing Work accomplished, condition of stored materials, environmental conditions, number of workers, general progress of Work, condition of substrates and adjacent construction, results of tests conducted, any deficiencies which had to be corrected or still require correction and deficiencies which have been corrected.

d. Manufacturer's Field Reports: As indicated.

e. Installers testing of assemblies in field.

1) Once per day during installation of air/vapor barrier test membrane for adhesion at random locations. Locations may be directed by Contractor.

2) Once per day during installation of air/vapor barrier test membrane, perform air/vapor leakage tests around ties, anchors or other penetrations at random locations per ASTM E 1186, Chamber Depressurization with Detection Liquid. Locations may be directed by Design Professional.

K. Inspection and Testing: Services of an Inspection and Testing Agency are required in conjunction with Work of this Section. Refer to Division 1. Air/vapor barrier will be inspected by Inspection and Testing Agency immediately prior to being covered by subsequent construction. Notify agency 48 hours in advance of commencement of Work that covers air/vapor barriers.

1.5 DELIVERY, HANDLING AND STORAGE

A. Shipping: Deliver in manufacturer's original labeled, undamaged containers.

B. Handling, Storage and Protection: Store off ground, out of weather and protected from excessive heat or cold.

1.6 FIELD CONDITIONS

A. Environmental Requirements: Comply with manufacturer's written recommendations for surface and weather conditions. Do not apply air/vapor barrier in snow, rain, fog or mist.

1.7 SEQUENCING

A. Sequence Work to permit installation of materials in conjunction with other vapor retardant materials and seals.

1.8 SPECIAL WARRANTY

A. General: Special Warranty shall not deprive Owner of rights under other provisions of Contract and shall be in addition to, and run concurrent with, other Warranties made by Contractor under requirements of Contract Documents.

B. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of air/vapor barrier that fail in materials or workmanship or fail to perform in accordance with specified criteria within specified Warranty Period including but not limited to loss of adhesion/cohesion, failure to cure, gaps, or failure to achieve an airtight and waterproof seal.

1) Specified Warranty Period: Three (3) years from Date of Substantial Completion.

2) System Includes: Primary membrane and seals to adjacent systems as indicated.

3) The installer of the air and vapor barrier system, and all its components, shall provide a three (3) year warranty covering all leaks that directly result from defective workmanship performed. All removal of overburden and re-installation of materials as well as access to the wall area should be included in the warranty.

Part 2 PRODUCTS

2.1 MANUFACTURERS

A. Products of indicated manufacturers are acceptable, contingent upon meeting specified requirements. Equivalent products of other manufacturers will be evaluated as substitutions in accordance with requirements of Division 1.

2.2 PRODUCTS

A. Subject to compliance with indicated requirements. Where a manufacturer's product line is indicated, select the product from the full line that complies with indicated requirements. Provide compatible flashing and accessories required to comply with indicated requirements.

1. System shall provide an air tight, waterproof, and vapor impermeable barrier.
2. Air Permeability: Maximum 0.004 cubic feet per minute per square foot {0.02 L/s per square meter} under a differential pressure of 1.57 psf when tested in accordance with ASTM E 2178.
    a. Resistance to Gust Wind Load: No increase in air leakage at a differential pressure of 60 psf maintained for 5 seconds.
    b. Resistance to Peak Wind Load: No increase in air leakage at a differential pressure of 20 psf maintained for one hour.
3. Vapor Permeance: Maximum of one perm per ASTM E 96.
4. Combustibility: Class A rating per ASTM E84.
5. Additional Performance Criteria: Capable to perform to criteria indicated for exterior enclosure assemblies in Exterior Enclosure, General: Division 7.

B. Membrane:

1. Fluid-Applied Air/Vapor Barrier: Single-component, elastomeric liquid which cures to a monolithic, rubberlike membrane, maximum 0.05 perms.
    a. Fire Resist Barritech VP, by Carlisle.

C. Membrane Flashing Sheets:

1. Self-Adhering Flashing Sheets:
    a. Fire resist CCW 705 FR-A by Carlisle.

2.3 ACCESSORIES

A. Tapes, Mastics, Sealants, Primers, Adhesives, Fasteners and Other Accessories: As recommended in writing by air/vapor barrier manufacturer, complying with NFPA 285.

B. Metal Termination Bars: Stainless steel, galvanized steel or aluminum to suit adjacent materials, approximately 1 inch wide by 1/8 inch, or channels formed from 16 gage sheet approximately 1 inch wide by 1/4 inch high, pre-punched for fasteners.

C. Sheet Metal Flashing: Division 7.

D. Anchors:

1. Material:
    a. Contacting Aluminum and Dissimilar Metals: Stainless steel, ASTM F 593 and ASTM F 594, Alloy Group 1.
    b. Contacting Steel or Galvanized Steel Only: Hot dip galvanized steel conforming with ASTM A 563 and ASTM A 153.
2. Anchors into Metal: Self-drilling, self-tapping type screws, minimum No. 8.

Part 3 EXECUTION

3.1 EXAMINATION

A. Project Site Verification of Conditions:

1. Examine substrates to which air/vapor barrier shall be applied for suitability and conformance to specified tolerances.
2. Report deficiencies to Contractor prior to commencing Work.

3. Commencing Work constitutes acceptance of substrate. Future Work or Rework required because of deficient substrates shall be performed at no additional cost.

4. Contractor to coordinate with Testing and Inspection Agency in accordance with 01470 Testing and Inspection of Exterior Enclosure.

3.2 PREPARATION

A. Protection: Protect adjacent surfaces that are not to receive air/vapor barrier.

B. Surface Preparation: Clean substrate of dust, dirt, oils or other deleterious materials. Knock off projections, fins or other irregularities. Fill voids and holes.

C. Joint Treatment: Bridge non-moving joints in panel type substrate with tape or membrane flashing as recommended in writing by manufacturer.

D. Priming: Prime substrate at application rate recommended in writing by manufacturer.

E. Bring substrate to a condition acceptable to manufacturer's technical representative and as required for system to comply with indicated requirements.

3.3 APPLICATION

A. General:

1. Install air/vapor barrier in accordance with approved submittals and additional written instructions from manufacturer as required.

2. Air/vapor barrier shall form a continuous envelope around conditioned spaces.

   a. Seal perimeter of each type of air/vapor barrier to adjacent air/vapor barrier or to intervening vapor impermeable materials.
   b. Seal penetrations to vapor impermeable materials.
   c. Vapor impermeable materials shall be metal or other materials with a perm rating of less than 1.
   d. When sealing air/vapor barriers to other vapor impermeable materials, seal joints in vapor impermeable material using mastics, sealants, tapes and sheets as recommended in writing by manufacturer.

B. Membrane Flashing: Install membrane flashing to bridge discontinuities in substrates, at gaps and joints, as required to accommodate movement of substrate and as recommended by manufacturer. Seal joints, corners and transitions in membrane flashing air and watertight.

1. Self-Adhering Flashing Sheets: Use within field of air/vapor barrier and to metal flashing and other compatible materials. Do not place in contact with silicone sealants. Do not span membrane without support beyond limits recommended by manufacturer. Provide sheet metal flashing for support if necessary, to bridge gaps beyond manufacturer's limits.

2. Self-supporting Flashing Sheets: Use to span open joints and gaps which accommodate movement, typically at building expansion joints, at movement joints between different systems and at control joints within systems. Provide a fold of excess membrane sized to accommodate movement. Anchor continuously on edges with metal termination bars.

3. Silicone Flashing Sheets: Use at transitions to aluminum curtainwall, windows and storefront and other metal systems which use silicone sealant as part of their installation. Provide a fold of excess membrane sized to accommodate movement. Anchor continuously on edges with metal termination bars if not mechanically captured in glazing system.

C. Self-adhering Sheet Type Air/vapor Barrier:

1. Position membrane for alignment with protective film in place. Roll back, remove film and press into place. Overlap ends and edges minimum 2 inches . Shingle in direction of flow of water.
2. At overhead conditions secure sheet to substrate with continuous metal bars perpendicular to side laps, spaced maximum 18 inches on center with mechanical anchors at maximum 12 inches on center.
3. Extend sufficiently at perimeter to allow connection to adjacent air/vapor barriers.
4. Shingle over sheet metal flashing and seal.
5. Roll field and seams, as recommended in writing by manufacturer, to ensure continuous contact.
6. Bridge movement joints change of material or discontinuity of substrate with strips of sheet membrane.
7. Seal to adjacent construction, window frames, curtainwall, penetrating ductwork, louvers or other similar penetrations, or perimeter conditions using membrane flashing.
8. Seal small, round or irregular penetrations such as ties, conduits, bolts and rods less than 1 inch in diameter with mastic or sealant.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Services:

1. Manufacturer's technical field representative shall visit Project Site
   a. During initial start of Work and examination of substrates.
   b. Periodically, once per week while Work of this Section is in progress.
   c. Upon completion of Work of this Section.
2. Representative shall prepare a report after each Project Site visit outlining general progress and deficiencies or deviations. Submit report to Contractor within three (3) working days.

3.5 PROTECTION

A. Protect air barriers from damage until covering Work is complete. Schedule Work of insulation board specified elsewhere which will cover air/vapor barrier to minimize time that barrier is exposed.

B. Repair damage to air/vapor barrier per manufacturer's written recommendations.

END OF SECTION 072500

fSECTION 074218.16 **METAL PANEL SYSTEM**

Part 1 GENERAL

1.1 RELATED DOCUMENTS SPECIFIED ELSEWHERE (NON-INCLUSIVE)

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Applicable Sections: Division 1.

C. Inspection and Testing Services: Division 1.

D. Inspection and Testing of Exterior Enclosure: Division 1.

E. Alternates: Division 1.

F. Fluoropolymer Coatings: Division 5.

G. Cold-Formed Metal Framing (CFMF): Division 5.

H. Sheathing: Division 6.

I. Exterior Enclosure, General: Division 7.

J. Building Insulation: Division 7.

K. Firestopping: Division 7.

L. Flashing and Sheet Metal: Division 7.

M. Joint Sealants: Division 7.

N. Doors and Windows: Division 8.

O. Glazing: Division 8.

1.2 SUMMARY (NON-INCLUSIVE)

A. Section Includes: Custom fabricated metal panels with a structure support system as follows:

1. Metal wall panels exterior.
2. Soffits exterior.
3. Copings and Fascias adjacent to the metal panels and precast concrete panels.
4. Trim material where the metal panels abut adjacent construction.
5. Secondary Framing support system, including thermal support clip system.

1.3 SUBMITTALS

A. Submit per the requirements of Division 1.

B. Shop Drawing: Show total layout, fabrication and installation details, materials, gauges, fasteners, flashing, trim pieces and closures. Distinguish factory and field assembly work. Indicated provisions for compliance with specified criteria.

1. Plans and Elevation: 1/4-inch equals 1-foot scale for each elevation.
2. Typical Bays: 1inch equals 1-foot scale for each typical bay.
3. Details: Minimum 3 inches equals 1-foot scale for each detail.
4. Show sufficient information of building structure, cold-formed steel framing, and zee girts to document coordination.
5. Show sufficient information of air/vapor retarder, insulation, sheathing and flashing to document coordination.
6. Show sufficient information of curtainwall, hollow metal and louvers to document coordination.

C. Product Data: Manufacturer's published product specifications, installation instructions, stand test reports and general recommendations for each product.

D. Manufacturers list and description of wall assemblies, incorporating product, approved per NFPA 285.

E. Samples:

1. Finish Samples: Three (3) sets of Samples, each piece 8 1/2 inches by 11 inches , demonstrating full range of variation in color, texture and finish. Three-hole punch Samples for binder per requirements of Fluoropolymer Coatings: Division 5.

F. Calculations: Structural calculations signed and sealed by Design Engineer certifying compliance with specified criteria. Calculations shall include the following:

1. Analysis of applicable loads on framing members and panels.
2. Analysis of loads on anchors including anchors embedded in concrete.

G. Qualifications: Manufacturer, fabricator and installer qualification documentation.

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1.4 DEFINITIONS

A. Refer to Exterior Enclosure, General: Division 7.

1.5 SYSTEM REQUIREMENTS

A. Design Requirements: Contractor is responsible for final design and engineering of panel and secondary support system to maintain design intent and conform to criteria indicated.

1. Contract documents indicate design intent and salient functional and aesthetic criteria.
2. Contractor shall design and engineer system to maintain design intent and to perform per criteria indicated.
3. Maintain basic dimensions of system, sight lines, jointing, and profiles. Minor variation is allowable only with approval by Design Professional and if variations are identified on submittals.
4. Engineer components of system not fully detailed, within a reasonable inference of design intent.

B. Structural Requirements: Design and size components to withstand loading and deflection criteria per Exterior Enclosure, General: Division 7. Maintenance Load: Each horizontal member shall be designed to support 300 pounds applied at any 1 square foot area or at any 1-foot long section in horizontal areas less than 1 foot wide.

C. Movement: Design system to accommodate movement criteria in accordance with Exterior Enclosure, General: Division 7.

D. Unacceptable Conditions: Vibration harmonics, wind whistles, noises caused by thermal movement, thermal movement transmitted to other building elements, loosening, weakening, or fracturing of attachments or components of system.

1.6 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer shall have minimum five (5) years documented experience producing systems similar to those required for this Project.

2. Designer shall be engineer licensed in the State of NJ and shall have minimum five (5) years' experience designing systems similar to those indicated.

3. Fabricator and installers shall have successfully completed a minimum of three (3) similar projects in the last five (5) years. Submit description of projects with Owner and Design Professional contacts.

4. Welding shall be performed by certified welders, qualified or licensed in accordance with local building regulations and shall conform to recommended practices of American Welding Society.

B. Regulatory Requirements: Provide UL labeled materials and systems where indicated.

C. Certifications: Comply with Exterior Enclosure, General: Division 7.

1. Certify that cold formed steel submittals represent a system adequate to support the metal panel system.

D. Mock-ups: Provide metal panel system required for mock-up specified in Exterior Enclosure, General: Division 7.

E. Preinstallation Meeting: Refer to Exterior Enclosure, General: Division 7.

F. Inspection: Services of an independent Inspection and Testing Agency shall be retained for Work of this Section. Refer to Inspection and Testing of Exterior Enclosure: Division 1.

G. Testing: Manufacturer shall submit independent test reports indicating that their system conforms with specified criteria. Refer to Inspection and Testing of Exterior Enclosure: Division 1.

1.7 DELIVERY, HANDLING AND STORAGE

A. Deliver panels and other components so they are not damaged or deformed. Package wall and roof panels for protection against transportation damage.

B. Handling: Exercise care in unloading, storing and erecting wall and roof covering panels to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with tarpaulins or other suitable weathertight ventilated covering. Store metal wall and roof panels so that they will not accumulate water. Do not store panels in contact with other materials that might cause staining, denting, or any other surface damage.

1.8 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F during and 48 hours after installation.

B. Verify that field measurements are as shown on Shop Drawings

1.9 COORDINATION

A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 . SEQUENCING

A. Do not cover work that is to be inspected or tested until directed.

1.11 SPECIAL WARRANTY

A. Finish Warranty: Furnish panel manufacturer's written Warranty covering failure of factory applied exterior finish on metal panels within Warranty Period. This Warranty shall be in addition to and not a limitation of other rights Owner may have against Contractor under Contract Documents.

B. Warranty Period: Twenty (20) years from Date of Substantial Completion.

C. Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

D. Rainscreen Exterior Wall Cladding System Warranty: The installer of the exterior rainscreen system, and all its components, shall provide a three (3) year warranty covering all leaks that directly result from defective workmanship performed for the exterior rainscreen system. All removal of overburden and re-installation of materials as well as access to the wall area should be included in the warranty.

Part 2 PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

A. Products of indicated manufacturers are acceptable, subject to compliance with Specifications. Equivalent products of other manufacturers will be evaluated as substitutions in accordance with requirements of Division 1.

1. Centria, Pittsburgh, PA, (888) 254-7099
2. Dri-Design, Holland, Michigan, (616) 355-2970.
3. Metal Sales and Services, Inc. (Metalwerks), 1-800-321-7816.

2.2 MATERIALS

A. Provide recycled content materials in accordance with Sustainability Action Plan specified in Sustainability Requirements: Division 1.

B. Use adhesives and sealants that comply with the VOC limits specified in Sustainability Requirements: Division 1.

C. Use field applied paints and coatings that comply with the VOC limits and chemical restrictions specified in Sustainability Requirements: Division 1.

D. Aluminum Sheet: Solid aluminum sheet or plate complying with ASTM B 209. Alloy, temper, heat treatment and surface preparation as determined by manufacturer to suit intended purpose.

E. Extruded Aluminum: Solid or Alcad coated extrusions complying with ASTM B 221. Alloy, temper, heat treatment and surface preparation as determined by manufacturer to suit intended purpose. Concealed extrusions to have mill finish. Exposed extrusions to have finish matching sheet or plate.

F. Cold Formed Steel Framing: Cold-rolled sections complying with ASTM C 955 and ASTM A 151 "Specification for the Design of Cold-Formed Steel Structural Members", hot-dip galvanized per ASTM A 653, G60 coating designation.

G. Steel Sections: ASTM A 36, galvanized per ASTM A 123.

H. Structural Steel Tubing: ASTM A 500, Grade B, galvanized in accordance with ASTM A 123.

2.3 PANEL SYSTEMS

A. Metal Panel Wall Assembly: Rain screen system.

1. Basis of Design:
    a. Centria BR%-36 Exposed fastener system.
    b. Refer to Elevations for Color locations and Specification Section 050300 Fluoropolymer Coatings.
2. Panel Material: .032 Aluminum.
3. Panel System Depth: 1 1/2" inches.
4. Attachment System: Glass Fiber Reinforced Plastic Girts
    a. Poltruded Glass-Fiber-Reinforced Girts: Z-shaped sections made by simultaneously pulling glass fibers and extruding thermosetting plastic resin through a heated die under pressure to produce a product without voids and with a high glass-fiber content..
        1) Configuration: Z shaped – 2" deep, installed to drain water.
        2) Girt shall be reinforced with galvanized steel sheet strips for engagement with screws and CFMF system.
        3) Basis of Design: GreenGirt Simple-Z by Smart, CI or approved equal.
        4) Fasteners: Unless otherwise indicated, provide stainless-steel. Select fasteners for type, grade and class required.
            a) Stainless Steel Screws: Self drilling, self-tapping, with neoprene washer.
            b) Stainless-Steel Bolts and Nuts: Regular hex head annealed stainless-steel bolts, nuts and where indicated, flat washers; ASTM F 593 for bolts and ASTM F594 for nuts.
            c) Post installed anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to 6 times the load imposed.
5. Allow for installation or removal of each panel without disturbing adjacent panels.

2.4 ACCESSORIES

A. Anchorage Clips and Fabrications: High-strength aluminum or nonmagnetic stainless steel or steel hot dip galvanized after fabrication per ASTM A 123.

B. Concrete Inserts: Cast-iron, malleable iron or steel hot dip galvanized after fabrication per ASTM A 123.

C. Fasteners:
1. Contacting Aluminum Only and Dissimilar Metals: Stainless steel, ASTM F 593 and ASTM F 594. Alloy Group 1, finish to match adjacent surface if exposed.
2. Contacting Steel or Galvanized Steel Only: Hot dip galvanized steel conforming with ASTM A 563 and ASTM A 153.

D. Coatings:
1. Shop Primer for Steel: SSPC-Paint 20.
2. Touch-up Primer for Galvanized Steel: Primer with minimum 80 percent zinc in dry film complying with SSPC 20.
3. Dissimilar Metal Coating: Cold-applied asphalt mastic or other non-conductive, non-absorptive material.

2.5 GLAZING SYSTEMS AND DOORS

A. Windows, storefront, curtainwall, glass, glazing and doors are specified in Doors and Windows: Division 8.

2.6 FLASHING, SHEET METAL AND BRAKE METAL

A. Flashing, sheet metal and brake metal are specified in Flashing and Sheet Metal: Division 7 and as follows:

1. Flashing concealed within the system shall be aluminum or stainless steel.
2. Concealed flashing where the system abuts dissimilar materials shall be minimum 20 gauge stainless steel.
3. Exposed flashing shall be material and finish to match panels, minimum 0.062 inch. Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
4. Brake metal shall be material and finish to match panels, minimum 0.125 inch.

2.7 SEALANTS

A. Concealed sealants within the system shall be ASTM C 920 silicone or epoxy or non-skinning polyisobutylene as recommended in writing by manufacturer.

B. Exposed sealants and sealants for use where system abuts other construction shall be as specified in Joint Sealants: Division 7.

2.8 SUPPORT SYSTEM

A. General: Fabricate in compliance with requirements indicated and approved submittals Mock-up.

B. Primary support system is specified in Cold-Formed Metal Framing (CFMF): Division 5.

1. Sub-framing Thermal "ZEE" framing per Cladding Engineers recommendations.

C. Provide support framing at perimeter; around windows, doors, louvers and openings and penetrations in metal panel; at intervals appropriate to span of metal panels; at edges and seams of panels if required for performance and as required by panel manufacturer.

D. Provide bracing of flanges of members within support system to limit rotation. Do not use internal gypsum wallboard as bracing.

E. Materials: Structural steel members or hollow structural shapes, or cold formed steel framing.

F. Coordinate support system with adjacent materials and assemblies. Allow for support where indicated.

G. Form and assemble in shop to greatest reasonable extent. Allow for both erection/fabrication tolerances and normal construction tolerances of supporting structure.

2.9 FABRICATION: GENERAL

A. General: Fabricate in compliance with requirements indicated and approved submittals and Field Sample Panel.

B. Panel System: Form and assemble entire panel system in shop to fullest extent possible. Indicate extent on Shop Drawings.

C. Fabricate Work to properly fit to adjacent construction without use of unscheduled closures or filler members.

D. Fabricate metal panel components allowing for accurate and rigid fit of joints within specified tolerances. Match components carefully ensuring continuity of line and design.

E. Flashing: Fabricate flashing and sheet metal in accordance with Flashing and Sheet Metal: Division 7.

F. Conceal fasteners, clips and anchorages within finished Work.

G. Grind welds smooth on exposed surfaces to blend seamlessly with adjacent surfaces. Restore damaged or discolored surfaces.

H. Uniformity: Abutting members shall not have an integral texture or color variation not greater than half the range indicated in approved Samples.

2.10 SHOP FINISHING

A. High Performance Organic Coating: As specified in Fluoropolymer Coatings: Division 5.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.11 SOURCE QUALITY CONTROL

A. Fabrication Tolerances: Fabricate panels to the following tolerances. Fabricate support system as required to conform to specified installation tolerances.

1. Length: Plus or minus 1/8 inch.
2. Width: Plus or minus 1/16 inch.
3. Diagonals: Plus or minus 1/8 inch.
4. Flatness: Maximum 1/8 inch] deviation from a true plane over entire panel and maximum 1/16 inch deviation in any 10 feet.

B. Inspection and Testing: Comply with requirements of Exterior Enclosure, General: Division 7.

Part 3 EXECUTION

3.1 EXAMINATION

A. Project Site Verification of Conditions:

1. Examine substrates to which support system and panels shall be applied for suitability and conformance to specified tolerances.
    a. Verify dimensions as related to approved submittals.
    b. Verify sills, wall openings and adjoining weather, air and vapor seal materials are ready to receive Work of this Section.

2. Report deficiencies to Contractor prior to commencing Work.

3. Commencing Work constitutes acceptance of substrate. Provide future work or re-work required because of deficient substrates at no additional cost to the owner.

3.2 PREPARATION

A. Furnish items to be imbedded in concrete or welded to structural steel and coordinate required locations.

B. Attach anchor clips to structure in accordance with approved submittals and to maintain structural capacity of anchors. Shim clips only to allow for proper alignment. Do not shim excessively to accommodate inadequate range of adjustment in clip. Use shims large enough to not reduce structural capacity of anchor clip or to allow rotation of clip.

C. Isolate dissimilar metals from metal panel system elements and each other. Coat metals that come into contact with masonry, concrete or treated wood.

D. Install support system in accordance with approved submittals Mock-up, and to meet specified criteria.

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3.3 INSTALLATION

A. Install metal panel system in accordance with approved submittals Field Sample, and to meet specified criteria.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities and to allow for movement criteria. Weld or otherwise permanently secure adjustable anchors after final alignment.

C. Coordinate installation of flashing and sheet metal work, in order to direct water and condensation behind panels to exterior without damage to adjacent construction.

D. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.

E. Coordinate attachment and seal of perimeter air barrier materials.

F. Firesafing: Refer to Firestopping: Division 7.

G. Glazing Systems and Doors: Refer to Glazing: Division 8.

H. Joint Sealants and Joint Fillers: Refer to Joint Sealants: Division 7.

I. Provide weathertight escutcheons for scuppers-penetrating panels.

J. Install components plumb, level, accurately aligned, and located in reference to column lines and floor levels within tolerances indicated.

K. No exposed fasteners allowed.

3.4 ERECTION TOLERANCES

A. Limit variations from plumb, level or dimensioned angle to the following:

1. 1/8-inch maximum deviation in any story height, or on any 10 foot vertical or angular run, or in any 20 foot horizontal run, non-cumulative.

2. 1/4 inch maximum deviation in any 40 foot run, any direction, non-cumulative.

B. Limit variations from location (theoretic calculated positions in plan or elevation based on established floor lines and column lines), including variations from plumb and level, to the following:

1. 1/4-inch total maximum deviation for any element at any location, non-cumulative.

2. 1/4-inch maximum change in deviation for any element for any [10 foot] {3 m} run, any direction, non-cumulative.

C. Limit offset in end-to-end or edge-to-edge alignments of adjoining consecutive elements indicated to be flush, continuous or planar to the following:

1. Interior: 1/32 inch.

2. Exterior: 1/16 inch.

D. Limit variation from indicated position in end-to-end edge-to-edge alignments of adjoining consecutive elements indicated to be less than 1/2 inch out-of-plane or are separated by a 1 inch to 2 1/2-inch-wide member to the following:

1. Interior: 1/16 inch.

2. Exterior: 1/8 inch.

E. Limit variation from indicated position in end-to-end or edge-to-edge alignments of adjoining consecutive elements indicated to be 1/2 inch or more out of plane to the following:

1. Interior: 1/8 inch.

2. Exterior: 3/16 inch.

F. Limit the maximum variation in width of a joint to plus or minus 1/16 inch.

G. Limit difference in diagonal measurements to 1/8 inch.

3.5 FIELD QUALITY CONTROL

A. Comply with requirements of Exterior Enclosure, General: Division 7.

3.6 TOUCHUP

A. Touchup damage to pre-finished surfaces.

3.7 CLEANING

A. Clean completed system, promptly after erection and installation of sealants, allowing for normal curing of liquid sealants.

B. Prior to Date of Substantial Completion, clean system thoroughly. Demonstrate proper cleaning methods and materials to Owner's maintenance personnel

3.8 PROTECTION

A. Protect Finished Work from damage.

B. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions.

C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074218.16

SECTION 074233 **PHENOLIC WALL PANELS**

Part 1 GENERAL

1.1 SECTION INCLUDES

A. Exterior solid phenolic cladding panel system and accessories as required for a complete drained and back-ventilated rainscreen

1. Wall panels.
2. Horizontal soffits

B. Interior solid phenolic cladding panel system and accessories.Cast-In-Place Concrete: Division 3.

1.2 RELATED SECTIONS

A. Section 05 50 00 -
Metal Fabrications; additional sub framing, Z girts to accommodate exterior insulation is not in the scope of

B. Section 07 21 00 – Thermal Insulation

C. 061600 - Sheathing

1.3 REFERENCES

A. ASTM International (ASTM):

1. ASTM B 117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.
2. ASTM D 635 - Standard Test Method for Small Scale Burning.
3. ASTM D 1929 - Standard Test Method for Ignition Temperature.
4. ASTM D 2244 -
Stadard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.
5. ASTM D 2247 - Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.
6. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
7. ASTM E 119 - Standard Test Method for Fire Rated or Fire Resistive Construction.
8. ASTM E 330 -
Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors Under the Influence of Wind Loads

B. International Organization for Standardization (ISO):

1. ISO 105 A02-93 - Tests for Color Fastness -- Part A02: Grey scale for assessing change in color.
2. ISO 178 - Determination of Flexural Properties
3. ISO 527-3 - Determination of Tensile Properties.
4. ISO 846 - Evaluation of the Action of Organisms.

C. National Fire Protection Association (NFPA)

1. NFPA 268 - Standard Test Method for Determining Ignitibility of Exterior Wall Assemblies Using a Radiant Heat Energy Source.
2. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components

1.4 SUBMITTALS

A. Submit per the requirements of Division 1.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Shop Drawings: Submit plan, section, elevation and perspective drawings necessary to describe and convey th e layout, profiles and product components, including edge conditions, panel joints, fixture location, anchorage , accessories, finish colors, patterns and textures.

D. Code Compliance: Documents showing product compliance with local building code shall be submitted prior t o the bid. These documents shall include, but not be limited to, appropriate Evaluation Reports and/or test rep orts supporting the use of the product. Alternate materials must be approved by the architect of record prior to the bid date.

E. Engineering Calculations: Submit engineering calculations as required by the local building code, showing that the installed panels and attachments system meets the wind load requirements for the project.

F. Selection Samples: For each finish product specified, two complete sets of color chips representing manufactur er's full range of available colors and patterns. Please note that samples are only representative for color and p attern and not for thickness of edge
finish. Metallic colors may also show a slight fluctuation in appearance do to the metal flake orientation from b atch to batch.

G. Verification Samples: For each finish product specified, two samples a minimum of 3.5 inches by 3.5 inches repr esenting actual product, color, and patterns. Sample edges may vary from field panel edges.

H. Operation and Maintenance Data: Submit operation, maintenance, and cleaning information for products co vered under this section.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: All primary panel products specified in this section will be supplied by a single ma nufacturer with a minimum of ten years experience.

1. Products covered under the Work listed in this section are to be manufactured in an ISO 9001 certified f acility.

B. Installer Qualifications: All products listed in this section are to be installed by a single installer trained and appro ved by the manufacture or representative.

C. Manufacturer's Field Services: Upon Owner's request, provide manufacturer's field service consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufac turer's instructions.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery:

1. During transportation, use stable, flat pallets that are at least the same dimension as the sheets.
2. Materials shall be packaged to minimize or eliminate the possibility of damage during shipping. Items such as wooden side boards, wooden lid, and spacers or protective sheeting between panels shall be used to protect the p anels from surface and/or edge damage.

B. Storage:

1. Store products in an enclosed area protected from direct sunlight, moisture and heat. Maintain a consisten t temperature and humidity.
2. Store products in manufacturer's unopened packaging until ready for installation.
3. Stack panels using protective dividers to avoid damage to decorative surface.
4. For horizontal storage, store sheets on pallet of equal or greater size as the sheets with a protective layer between the pallet and sheet and on top of the uppermost sheet.
5. Do not store sheets, or fabricated panels vertically.

C. Handling:

1. Remove protective film within 24 hours of the panels being removed from the pallet.

2. When moving sheets, lift evenly to avoid dragging panels across each other and scratching the decorativ e surface.

3. Remove all labels and stickers immediately after installation.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by ma nufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's a bsolute limits.

B. Field Measurements: Verify actual measurements/openings by field measurements performed by the installer p rior to release for fabrication. Recorded measurements to be indicated on shop drawings based on field measu rements provided by the installer. Coordinate field measurements and fabrication schedule with construction p rogress to avoid construction delays.

1.8 WARRANTY

A. Warranty: At project closeout, provide manufacturer's limited ten year warranty covering defects in materials.

Warranty only available when material installed by an installation contractor trained and approved by the man

ufacturer's representative.

Part 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Products of Trespa North America, Ltd. are indicated to establish desired quality and performance of Work. Equivalent products of other manufacturers will be evaluated as substitutions in accordance with requirements of Division 1.

2.2 MATERIALS

A. Solid Phenolic Wall Panels: Trespa Meteon

1. Color on Primary Face: Sienna Brown A10.4.5 with black reverse.

2. Finish: Satin Sheen

3. Panel core: Fire retardant (FR) black core.

4. Panel Thickness: 3/8 inch

5. Physical Properties:

   a. Modulus of Elasticity: 1,300,000 psi minimum, ISO 178.
   b. Tensile Strength: 10,100 psi minimum, ISO 527-2.
   c. Flexural Strength: 14,500psi minimum, ISO 178.
   d. Thermal Conductivity: 2.1 BTU/inch/ft2.hr.°F, EN 12524.
   e. Structural Performance (ASTM E330)

      1) Panels shall be designed to withstand the Design Wind Load based upon the local building co de, but in no case less

      than 15 pounds per square foot (psf). Wind load testing shall be done in accordance with this stand ard to obtain the following results:

      2) Normal to the plane of the wall, the maximum panel deflection shall not exceed L/175

3) Normal to the plane of the wall between supports, deflection of the aluminum sub-framing members shall not exceed L/175 or 3/4 inch, whichever is less.

f. Fire Performance:

1) Flame Spread: Class A, ASTM E 84

2) Smoke Development: Less than 450, ASTM E 84.

B. Mounting System:

1. TS210 – Concealed fastening over fixed depth aluminum sub-framing.

C. Aluminum Sub Structure: Aluminum sub-structure esigned to withstand structurel loading due to wind load and the dead load of the panel, painted as required to conceal behind the open joinery of the attachement system.

1. Extrusions, including corner closures joint closures and vent screens, formed members, sheet and plate shall conform with the recommendations of the manufactuer.

D. Extruded Aluminum Trim: As indicated in section 050300 Fluoropolymer Coatings.

E. Concealed Fasteners: Fasteners shall be non-corrosive and as recommended by panel manufacturer.

2.3 FABRICATION

A. Panel Dimensions: All dimensions shall be verified in the field and panel fabrication shall be done under controlled shop conditions.

B. Appearance: Panel lines, breaks, and angles shall be sharp, true, and surfaces free from warp and buckle.

Part 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Surfaces to receive panels shall be even, smooth, dry, and free from defects detrimental to the installation of th e panel system. Notify Contractor in writing of conditions detrimental to proper and timely completion of the w ork.

C. Confirm exterior sheathing is plumb and level, with no deflection greater than 1/4 inch in 20 feet.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation bef ore proceeding. Do not proceed with installation until unsatisfactory conditions have been corrected

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substr ate under the project conditions.

3.3 INSTALLATION

A. Install solid phenolic wall panels and sub-frame system in accordance with manufacturer's instructions.

B. Install solid phenolic wall panels plumb and level and accurately spaced in accordance with manufacturer's re commendations and approved submittals and drawings.

C. Anchor panels and subframing securely per engineering recommendations and in accordance with approved shop drawings to allow for necessary movement and structural support.

D. Fasten solid phenolic wall panels with fasteners approved for use with supporting substrate.

E. Do not install panels or component parts which are observed to be defective or damaged including, but not li mited to: warped, bowed, abraded, scratched, and broken members.

F. Do not cut or trim component parts during installation in a manner that would damage the finish, decrease the strength, or result in visual imperfection or a failure in performance. Return component parts with require alterati on to the shop for re-fabrication or replacement.

G. Install corner profiles and trim with fasteners appropriate for use with adjoining construction as indicated on the Contract Drawings and as recommended by manufacturer

3.4 FIELD QUALITY CONTROL

A. Remove masking or panel protection as soon as possible after installation. Any masking intentionally left in plac e after panel installation on an elevation, shall become the responsibility of the General Contractor to remove.

B. Adjust final panel installation so that all joints are true and even throughout the installation. Panels out of plane s hall be adjusted with the surrounding panels to minimize any imperfection.

C. Repair panels with minor damage. Remove and replace panels damaged beyond repair as a direct result of th e panel installation.

After installation, panel repair and replacement shall become the responsibility of the General Contractor.

D. Clean finished surfaces as recommended by panel manufacturer. After installation cleaning, cleaning during c onstruction shall become the responsibility of the General Contractor.

END OF SECTION 074233

SECTION 075423 SINGLE -PLY ROOFING

Part 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Applicable Sections: Division 1.

C. Inspection and Testing Services: Division 1.

D. Inspection and Testing of Roofing: Division 1.

E. Rough Carpentry: Division 6.

F. Exterior Enclosure, General: Division 7.

G. Flashing and Sheet Metal: Division 7.

H. Roof Accessories: Division 7.

I. Mechanical: Division 23, refer to for equipment mounted on or penetrating roof.

J. Electrical: Division 26, refer to for equipment mounted on or penetrating roof.

1.2 SUMMARY (NON-INCLUSIVE)

A. Section Includes: Roofing system consisting of single-ply, with fully-adhered portions as required for uplift resistance, fully-adhered, TPO membrane plus insulation, insulation cover board and accessories.

1.3 DEFINITIONS

A. Roofing Systems: Components required to maintain building watertight from substrate up to top of base flashing including, but not limited to, substrate primers, insulation, insulation cover board, attachments, membrane, coatings and base flashing.

B. Additional Roofing Terminology: Definitions in ASTM D 1079 and glossary in NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to Work of this Section

1.4 SUBMITTALS

A. Submit per requirements of Division 1.

1. Exterior Enclosure submittals will not be reviewed without receipt of Preliminary Certification letters indicated in Inspection and Testing of Roofing: Division 1.

2. Coordinate and submit concurrently, submittals required in other Sections that affect Work of this Section.

B. Shop Drawings: Indicate joint, penetration and termination conditions and conditions of interface with adjacent walls, parapets, and other materials and as follows: Show all layers of the roof system starting from the substrate. Show continuity with other weather-resistive materials and air/vapor retarder materials. Include sufficient detail to indicate compliance with conditions unique for this Project.

1. Submit plan at minimum 1/8-inch equals 1 foot.
2. Submit details at minimum 3 inches equals 1 foot.
3. Relative elevations and slopes of substrates and finished roof surface.
4. Drain locations and size of sumps.
5. Parapet and edge details.
6. Location of tapered edge strips.
7. Curbs, rails, hatches, and vents in accordance with Roof Accessories: Division 7.
8. Expansion joints and area dividers.
9. All flashing details.
10. Walkway pad layouts.
11. Layout of components including all layers of roof assembly.
12. Tapered insulation:
    a. Layout of insulation showing slopes, crickets, valleys and drain locations.
    b. Longitudinal and transverse sections showing insulation layers.
13. Roof top equipment and penetrations required for Work of other specification Divisions.

C. Product Data: For each component or material used in system including accessories, primers, and other miscellaneous products.

D. Samples:
1. Paper sample of "Roofing Identification Sign", with information completed for this Project.
2. Full size sample of sheet metal scupper box.

E. Qualifications: Manufacturers and installers qualifications.

F. Quality Control Procedures: Submit Manufacturer's Field Reports within one (1) week after inspection.

G. Certifications: Written certification letters where specified.

H. Sustainability Submittals: Provide the following in accordance with Sustainability Requirements: Division 1.
1. Materials Sustainability Documentation Form.
2. Product data, certification letter, and costs for materials with recycled content.
3. Product data and costs for regional materials.
4. Product data for adhesives and sealants indicating VOC content.
5. Product data for paints and coatings indicating VOC content and chemical composition.
6. Product test reports indicating that roof materials comply with Solar Reflectance Index requirement.

I. Closeout Submittals:
1. Special Warranty:
    a. Intent to Warrant letter. Do not commence Work without approval of Intent to Warrant.
    b. Executed Warranty after completion of Work.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

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1.6 PERFORMANCE REQUIREMENTS

A. Roofing manufacturer shall select products and installation techniques to conform to indicated requirements. Thicknesses and material descriptions indicated are minimums. Provide thicker materials or materials with higher performance values if required by roof manufacturer to comply with the indicated performance requirements or if required to issue indicated warranty.

1. Best Practice: Provide materials and detailing which provides most proven durability, generally as recommended by manufacturer for twenty (20) year warranty, whether a twenty (20) year warranty is specified or not.

B. UL Listing: Provide single-ply roofing system and component materials that have been tested for application and slopes indicated and are listed by Underwriters Laboratories, Inc. (UL) for Class A external fire exposure.

1. Provide roof-covering materials bearing UL Classification Marking on bundle, package, or container indicating that materials have been produced under UL's Classification and Follow-up Service.

2. Provide single-ply roofing system that can be installed to comply with UL requirements for Fire Classified and Class 60 wind-uplift requirements.

3. Provide single-ply roofing system that complies with UL requirements for indicated fire rating for Roof/Ceiling Assembly.

C. Solar Reflectance: Provide a low-slope ENERGY STAR roofing system with initial solar reflectance not less than 0.70, emissivity not less than 0.75, and Solar Reflectance Index not less than 78 when tested according to CRRC-1 and ASTM E 1980.

1.7 QUALITY ASSURANCE

A. Manufacturer's Qualification: Manufacturers shall have ten (10) years documented experience producing roofing membranes of the same Type as those required for this Project.

B. Installer's Qualification: Installer shall have satisfactorily completed minimum three (3) projects of similar system, scope and complexity within last one (1) year. Installer shall currently be licensed and approved by manufacturer and shall have been so for previous three (3) years. Submit list of projects with Owner and Design Professional contact with telephone numbers and manufacturer's certification.

C. Single Source Requirements: Primary products and materials required to complete system shall be produced directly by listed manufacturer. Secondary products including insulation, primers, anchors, and may be produced by a secondary manufacturer approved in writing by primary manufacturer.

D. Regulatory Requirements: Comply with applicable Volatile Organic Compounds (VOCs) regulations.

E. Referenced Codes and Standards: Comply with the following in accordance with Division 1.

1. National Roofing Contractors Association (NRCA): Roofing and Waterproofing Manual

2. FM Global System (FMG) I-28 Insulated Metal Deck Loss Prevention Data Sheet 1-29 Adhered or Mechanically Attached Single Ply Membrane Roof Systems and Other Applicable Requirements

3. Single-Ply Roofing Institute (SPRI): Flexible Membrane Roofing: A Professional's Guide to Specifications

F. Certifications:

1. Manufacturer's certification that installer is approved for this Project and has been an approved installer as required above.

2. System Certification Letter: Manufacturer's certification as follows:

a. List information specific to this project, including Owner, Contractor, Building, and location.
b. List each material required for roofing system.

c. Certification of single source responsibility.
d. Certification of acceptance of secondary products manufactured by Others.
e. Certification of acceptance of products specified elsewhere which are installed within or in contact with roofing system.
f. Certification that products and materials comprising roofing system are compatible with each other and with adjacent materials they may contact.
g. Certification that roof systems comply with specified UL requirements.
h. Certification that roof system is eligible for indicated warranty.

G. Insurance Certification: Assist Owner's Representative in preparation and submittal of roof installation acceptance certification as may be necessary in connection with fire and extended coverage insurance on roofing and associated work.

1.8 PREINSTALLATION MEETINGS

A. Preliminary Roofing Conference: As soon as possible after award of roofing work and before initial submittals, meet with Installer (Roofer), installers of substrate construction (roof decks) and other work adjoining roof system including penetrating work and roof accessories, Design Professional, Owner's Representative, Inspecting Agent, and representatives of other entities directly concerned with performance of roofing system including (as applicable) Owner's insurers.

1. Review requirements (Contract Documents), submittals, status of coordinating work, availability of materials, substrate requirement and installation facilities, and establish preliminary installation schedule. Review requirements for inspections, testing, certifications, forecasted weather conditions, governing regulations, insurance requirements, and proposed installation procedures.

2. Discuss roofing system protection requirements for construction period extending beyond roofing installation. Discuss possible need for temporary roofing.

3. Confirm that all parties involved are aware of Warranty requirements and Intent to Warrant letter has been submitted and approved.

4. Record discussion, including agreement or disagreement on matters of significance; furnish copy of recorded discussions to each participant. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.

B. Preapplication Roofing Conference: Approximately two (2) weeks before scheduled commencement of roofing installation and associated work, meet at Project Site with Installer, installer of each component of associated work, installers of deck or substrate construction to receive roofing work, installers of rooftop units and other work in and around roofing that must precede or follow roofing work, including mechanical work, if any, Design Professional, Owner's Representative, Inspection Agent, roofing system manufacturer's representative, and other representatives directly concerned with performance of Work, including, where applicable, Owner's insurers, and governing authorities.

1. Review foreseeable methods and procedures related to roofing work, including, but not limited to, the following:

a. Tour representative areas of roofing substrates (decks) inspect and discuss condition of substrate, roof drains, curbs, penetrations, and other preparatory work performed by other trades.
b. Review structural loading limitations of steel deck and inspect deck for loss of flatness and for required mechanical fastening.
c. Review roofing system requirements included on Drawings, Specifications, and other Contract Documents.
d. Review required submittals, completed and yet to be completed.
e. Review Intent to Warrant and unexecuted Warranties.
f. Review and finalize construction schedule related to roofing work and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
g. Review required inspection, testing, certifying and material usage accounting procedures.

h. Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions, including possibility of temporary roofing, if not a mandatory requirement.

2. Record Contractor discussions of conference, including decisions and agreements or disagreements reached, and furnish copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.

C. Review temporary protection requirements for roofing system during and after installation.

D. Review roof observation and repair procedures after roofing installation.

E. Inspection and Testing: Services of an independent Inspection and Testing Agency will be required in relation to Work of this Section. Refer to Division 1.

F. Coordination: Contractor shall coordinate Work specified in other Sections affecting roof in any way.

1.9 DELIVERY, HANDLING AND STORAGE

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store materials on pallets or other similar raised platform and protected from weather.

C. Do not overload structure by storing large amounts of material in one (1) area.

D. Store adhesives and other temperature sensitive materials between 60 degrees F and 80 degrees F.

1.10 FIELD CONDITIONS

A. Application of roofing shall not commence or proceed during inclement weather or if precipitation is more than 50 percent likely during next 8-hour period per National Weather Service or if temperatures are outside of manufacturer's written instructions.

1.11 SEQUENCING

A. Coordinate Work to minimize construction traffic required over complete roofing system.

1.12 SPECIAL WARRANTY

A. Intent to Warrant: Submit an Intent to Warrant executed by authorized representative of roof membrane system manufacturer, indicating that manufacturer has reviewed Drawings and Specifications, conditions affecting work and relationship of roof membrane system with related work, and that manufacturer proposes to provide warranty as referenced without further stipulation.

B. Manufacturer's Warranty:

1. Provide a ten (10) year warranty from manufacturer, signed by an authorized representative of manufacturer which shall warrant that manufacturer shall repair any defective workmanship and replace any defective material within roofing system as indicated.

2. The following exclusions are permitted in Warranty:

a. Natural disasters such as lightning, hail, floods, and earthquakes.
b. Damage from traffic or storage of material on roof.
c. Structural failure of roof deck, parapet or coping.
d. Infiltration of moisture in, through or around walls, coping or building structure.

e. Movement or deterioration of metal counterflashing or other metal components adjacent to roof.
f. Damage to building (other than roofing system components) or its contents.

3. Warranty shall include coverage for failure due to wind velocities up to 90 miles per hour.

4. Warranty shall provide that if upon proper notification Warrantor fails to promptly repair roof, Owner may make temporary repairs to avoid damage to facility. Such action shall not be considered a breach of provisions of Warranty.

5. Owner shall be permitted to make alterations, additions and repairs to roof within written approved guidelines of Warrantor without jeopardizing unexpired portion of Warranty's original term.

6. There shall be no deviations from these Specifications or from requirements of roofing material manufacturer that would prevent issuing of Warranty.

1.13 OWNER'S INSTRUCTIONS

A. Care and Maintenance: Provide manufacturer's written Roof Maintenance Plan customized for Project, for maintenance of roof including, for example, inspection schedules, trouble shooting, early signs of a potential problem and temporary emergency repairs.

B. Roofing Identification Sign: Provide an engraved plastic sign, white with black letters, approximately 8 1/2 inches by 11 inches indicating the following: Mount sign in stairwell which accesses roof.

1. Roof manufacturer with emergency telephone number.

2. Roofing Contractor with emergency telephone number.

3. Contractor.

4. Design Professional.

5. Date of Substantial Completion.

6. Length of Warranty.

7. Description of each material used in system.

Part 2 PRODUCTS

2.1 MANUFACTURER

A. Subject to compliance with specified criteria, provide primary system components manufactured by one (1) of the following: Substitutions of equivalent products will be considered per requirements of Division 1.

1. TPO:

a. Carlisle Syntec Systems.
b. Firestone Building Products Co.

2.2 MATERIALS, GENERAL

A. Use adhesives and sealants that comply with the VOC limits specified in Sustainability Requirements: Division 1.

B. Use paints and coatings that comply with the VOC limits and chemical restrictions specified in Sustainability Requirements: Division 1.

2.3 ROOFING MEMBRANE

A. TPO: A Fabric-Reinforced Thermoplastic Polyolefin Sheet complying with ASTM D 6878.

B. Thickness: Minimum 60 mils {1.5 mm} nominal thickness.

C. Reinforcement: Fiberglass or polyester as required to meet performance criteria.

D. Exposed Field Face Color: White

   a. Back of Roof Parapets and Scuppers: White

2.4 INSULATION

A. Polyisocyanurate: Rigid closed-cell foam boards permanently bonded to non-asphaltic glass fiber facing sheet complying with ASTM C 1289, UL Class A, FMG Class 1 and the following:

   1. Compressive Strength per ASTM D 1621: Minimum 125 psi Maximum Face Size: 4 feet by 4 feet .

   2. R-value for a 1 inch tested per ASTM C 518 and conditioned per RIC/TIMA 281-1: Minimum 5.7

   3. Minimum Thickness over entire roof surface: 5 inches.

      a. Maintain 4 inches of roof insulation at drains.

   4. Crickets: Same material as insulation, tapered so finished surface slopes minimum 1/4 inches per foot {1:50}.

   5. Tapered Insulation: refer to drawings for location

      a. Slope of finished surface: Minimum 1/4 inch per foot including crickets.
      b. Minimum thickness measured at perimeter of drain sumps: 2 inches.
      c. Contractor's Option: Tapered edge strip insulation may be deleted if Roofing Contractor provides positive drainage away from roof edge and smooth transition between roofing and parapet. Deletion of tapered edge strip shall not void roofing warranty.

B. Insulation Cover Board: Silicone impregnated gypsum board core panels with integral glass fiber facers, 5/8-inch-thick, factory pre-primed, FM Global approved, complying with ASTM C 1177,

   1. Dens Deck by Georgia-Pacific Corp.

2.5 BONDING MATERIALS

A. Membrane Adhesives: 100 percent full coverage, supplied by same manufacturer as membrane and formulated for use with roof membrane and insulation, inert to weathering by withstanding oxidation, ozonization, hydrolysis, and chemical attach from ponded water. Adhesive shall withstand specified uplift force. Adhesive shall be compliant with all Volatile Organic Compounds (VOCs) regulations.

B. Flashing Cement Mastics, and Sealants: Supplied or approved by membrane manufacturer. Comply with all Volatile Organic Compounds (VOCs) regulations.

2.6 ACCESSORY MATERIALS

A. Accessory materials shall be as recommended in writing by membrane manufacturer, as required to comply with specified criteria, and appropriate for a 20-year warranted system whether or not such a warranty is being offered.

B. Traffic Pads: Surfaced molded recycled PVC pad approximately 24 inches by 24 inches by 1/4 inch as recommended in writing by membrane manufacturer. Layers of additional membrane are not acceptable as traffic pads.

1. Extra Materials: Deliver to Project Site, at completion of Project, 25 extra traffic pads. Store traffic pads on site at location directed by Owner.

C. TPO Base Flashing: Use TPO membrane.

1. Furnish factory pre-molded inside and outside corner units recommended in writing by manufacturer.

D. Pre-molded Flashing Boots: Manufacturer's standard conical elastomeric boots, molded to fit pipe penetrations.

E. Mechanical Fasteners: Corrosion-resistant per FMG 4470 criteria as recommended by membrane manufacturer and insulation manufacturer for deck type and complying with fire and insurance uplift rating requirements. Provide system tested and approved for specified wind uplift rating.

F. Tapered Edge Strips (Contractors Option if not required by roofing manufacturer for Roofing Warranty): 1 1/2 inches high by 18 inches wide, same material as insulation.

G. Termination Bar: 3/32 inch thick extruded aluminum or 14 gage formed galvanized steel or stainless steel channel approximately 1 inch wide and punched with elongated holes approximately 1 inch on center.

H. Wood Curbs, Nailers and Blocking: Refer to Rough Carpentry: Division 6.

I. Metal Curbs, Rails, Hatches and Pipe Curb Assemblies: Per Roof Accessories: Division 7.

J. Anchors for Laminated Metal Flashing: Refer to Flashing and Sheet Metal: Division 7.

2.7 LAMINATED METAL FLASHING FABRICATION

A. Shop fabricate laminated metal flashing to form edge flashing and scuppers as indicated in accordance with requirements of Flashing and Sheet Metal: Division 7.

B. Shop fabricate inside and outside corners, transitions and terminations in accordance with requirements of Flashing and Sheet Metal: Division 7. Form inside corners with a 1-inch cant.

Part 3 EXECUTION

3.1 EXAMINATION

A. Examine substrate surfaces to receive single-ply roofing system and associated work and conditions under which roofing will be installed.

1. Verify roof openings, pipes, conduit, sleeves, ducts, and vents through roof are solidly set, and wood nailers, counterflashing receivers are in place.

2. Verify that curbs, rails, pipe curb assemblies, roof top mechanical equipment and other roof-mounted elements specified elsewhere are in place and properly anchored.

3. Verify that surrounding parapets, roof edges and walls are properly prepared for application of roofing system.

4. Verify deck is supported and secured.

5. Verify deck is clean and smooth, free of depressions, waves, or projections, properly sloped to valleys.

6. Verify deck surfaces are dry and free of snow or ice. Verify flutes of metal deck are clean and dry.

7. Verify concrete substrates have a moisture content below manufacturer's published maximum recommended value.

8. Verify that penetrating elements have indicated air seal or firestopping.

B. Test Concrete substrate for excessive moisture by pouring 1 pint {0.47 L} of hot bitumen at [400 degrees F] {204 degrees C} or EVT on deck at start of each day's work and at start of each roof area or plane. Do not proceed with roofing if test sample foams or can be easily and cleanly stripped after cooling.

C. Reporting: Report defects or deficiencies in writing to Contractor, Design Professional and Owner's Representatives.

D. Do not proceed with roofing work until defects or deficiencies have been corrected.

E. Acceptance: Commencement of roofing work constitutes acceptance of substrate. Provide removal and replacement of roofing required for, or caused by, defects or deficiencies in substrate, including damp materials at no additional cost.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Protect adjacent surface from staining or soiling caused by roofing application. Prevent liquid materials from entering or clogging drains, pipes, conduits or conductors. Prevent foreign materials from entering or clogging roof drains, scuppers or downspouts.

C. Coordinate installing roofing system components so that insulation, and insulation cover board are not exposed to precipitation or left exposed overnight. Provide watertight cut offs at end of each day's work to cover exposed sheets and insulation. Remove cut offs immediately before resuming Work.

D. Asphalt Bitumen:

1. Heating: Each kettle shall have a large operational easy to read thermometer. Heat and apply bitumen according to EVT Method as recommended by NRCA. Do not raise temperature above minimum normal fluid-holding temperature necessary to attain EVT (plus 5 degrees F, at point of application) more than 1 hour prior to time of application. Determine flash point, finished blowing temperature, EVT, and fire-safe handling temperature of bitumen either by written information from manufacturer or by suitable tests. Do not exceed written recommended temperature limits during bitumen heating. Do not heat bitumen to a temperature higher than 25 degrees F below flash point. Discard bitumen that has been held at temperature exceeding finished blowing temperature (FBT) for more than 3 hours. Keep kettle lid closed except when adding bitumen.

2. Substrate Joint Penetrations: Prevent bitumen from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction. Where mopping is applied directly to substrate, tape substrate joints or, otherwise seal joints to control flow of bitumen.

3. Apply primer to concrete substrate in accordance with manufacturer's written instructions.

3.3 INSULATION INSTALLATION

A. General: Comply with approved submittals, Specifications, and manufacturer's written instructions for a 20-year warrantable system whether or not such a warranty is required.

B. Insulation Application:

1. General:

a. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.
b. Lay tapered boards, tapered edge strips, or cut boards to slope to form a minimum 3 feet square by 1 1/2 inch deep sump at roof drains.
c. Apply no more insulation than can be covered roofing intersects a vertical surface or a curb, at all penetrations, at perimeter of roof edge and as indicated.
d. Use tapered insulation or tapered edge strips to form crickets to direct water to roof drains. Install crickets behind all roof penetrations or irregularities, for example, roof-mounted equipment, curbs, rails and hatches which cross the down slope flow of water.

e. Place tapered thickness insulation to required slope pattern in accordance with manufacturer's written instructions and approved submittals.
f. Insulation cover board shall be top layer of insulation assembly. Cut insulation cover board to follow slope of roof insulation at tapered edge strips, crickets, valleys, ridges and other breaks in slope.

2. Insulation, Fully-Adhered Base Layer with Fully-Adhered Top Layer(s):

a. Place boards with edges over flute surface for bearing support.
b. Fully adhere base insulation layer to substrate in accordance with insulation manufacturer's written instructions and as required to comply with specified uplift criteria. Perform pull test per manufacturer's instructions to ensure bond to substrate.
c. Set subsequent layers of insulation and insulation cover board, including crickets and tapered units in 100 percent hot mopping of Type III asphalt at rate of (25 pounds per square) (plus or minus 15 percent on total Project basis).
d. Offset joints in each layer of insulation minimum 6 inches from joints in layer below.

3.4 ADHERED ROOFING INSTALLATION

A. TPO Membrane Application Fully Adhered:

1. Adhere membrane roofing over area to receive roofing and install according to membrane roofing system manufacturer's written instructions.

2. Start installation of membrane roofing in presence of membrane roofing system manufacturer's technical personnel.

3. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

4. Bonding Adhesive: Apply to substrate and underside of membrane roofing at rate required by manufacturer and allow to partially dry before installing membrane roofing. Do not apply to splice area of membrane roofing.

5. In addition to adhering, mechanically fasten membrane roofing securely at terminations, penetrations, and perimeter of roofing.

6. Apply membrane roofing with side laps shingled with slope of roof deck where possible.

7. Seams: Clean seam areas, overlap membrane roofing, and hot-air weld side and end laps of membrane roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.

a. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet membrane.
b. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
c. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.

8. Spread sealant bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.

B. TPO Flashings and Accessories:

1. Apply base flashings to seal membrane to vertical elements and penetrations. Install prefabricated corners. Form corners and special shapes with uncured sheets only when prefabricated shapes are not available.

2. Secure top of base flashing with roofing nails maximum 12 inches on center or with termination bar secured maximum 18 inches on center.

3. Coordinate overlap of base flashing under copings and other flashings with air/vapor barrier as indicated. Overlap shall occur on vertical surface and shall be shingled in the direction of flow.

4. Flash each penetrating pipe, conduit, tube or other similar elements using prefabricated flashing boots or pipe curb assembly specified in Roof Accessories: Division 7.

5. Coordinate installation of roof drains, sumps and related flashings.

6. Pitch pockets are not allowed.

C. Scuppers and Overflows: Verify that rough opening for has been lined with air/vapor barrier membrane flashing. Install shop fabricated scuppers and overflows under roofing membrane. Mechanically anchor at maximum 6 inches on center around perimeter of both faces and not less than two (2) anchors per leg. Seal roof membrane to scupper with adhesive at TPO membrane.

D. Traffic Pads: Install Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads using cold adhesive as recommended in writing by manufacturer in locations indicated. Space pads to allow for drainage.

1) Size: Manufacturer's standard dimension.

2) Color: Contrasting with roof membrane.

3.5 FIELD QUALITY CONTROL

A. Inspection: Services of an independent Inspection and Testing Agency shall be used in relation to this Work to perform tests and to inspect substrate conditions, surface preparation, roof membrane application, sheet flashings, protection, and drainage components, and to furnish reports to Architect.

B. Moisture Test: Prior to Date of Substantial Completion, independent Inspection and Testing Agency specified in Division 1 will survey roof to search for leaks demonstrated by wet insulation.

1. If there has not been rainfall of at least 1 inch in 24 hours during two (2) week period prior to test, use hoses and sprinklers to thoroughly soak roof surface for 12 hours. Submit request for change order for cost of soaking if required. Do not include cost of soaking in Base Price.

2. If leaks or wet underlying materials are found, remove membrane and wet materials, let system dry and repair system. Contractor shall pay for retesting by original independent Inspection and Testing Agency until no leaks or wet underlying materials are discovered.

C. Manufacturer's Representative: Manufacturer's technical field representative shall inspect construction activities, at start of work, minimum two (2) hours per week during work and at completion of each area of work. Representative shall attend meetings concerning roofing when indicated or as scheduled to coordinate Work. Representative shall submit a written report after each inspection noting as a minimum weather conditions, condition of stored materials, work in progress, condition of substrates, number of workers and which workers have completed manufacturers' training programs, and all other pertinent data. Services of manufacturer's field representative are not intended to supersede manufacturer's written requirements for inspection to issue Warranty.

3.6 CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing system, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean roof areas of roofing tools, unused materials and debris.

D. Clean spilled adhesive or other materials from exposed surfaces that were not to receive roofing.

3.7 PROTECTION

A. Protect roof system from construction traffic. Apply temporary protection if roof system is extensive roof traffic is required.

3.8 ROOFING SCHEDULE

A. Roof Assembly - Type 1:

1. Substrate: Metal Deck.
2. Vapor Retarder: None.
3. Insulation: Constant thickness and Tapered Polyisocyanurate, fully adhered bottom layer, top layers fully adhered.
4. Insulation Cover Board: Siliconized Gypsum sheathing, Fully Adhered.
5. Roof Membrane: TPO sheet, Fully Adhered.

END OF SECTION 075423

SECTION 076200 FLASHING AND SHEET METAL

Part 1 GENERAL

1.1 RELATED DOCUMENTS SPECIFIED ELSEWHERE (NON-INCLUSIVE)

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Applicable Sections: Division 1.

C. Metal Panel System: Division 7, refer to for metal panel roofing and siding.

D. Roofing: Division 7, refer to for manufactured roof components and accessories.

E. Exterior Enclosure, General: Division 7.

F. Joint Sealants: Division 7.

G. Counterflashing of Mechanical Elements: Division 23.

1.2 SUMMARY (NON-INCLUSIVE)

A. Section Includes: Custom fabricated flashing and sheet metal including:

1. Metal counterflashing and receivers.
2. Built-in scuppers.
3. Exposed metal trim.
4. Miscellaneous sheet metal not otherwise specified.

1.3 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.4 SUBMITTALS

A. Submit per the requirements of Division 1.

B. Coordinate flashing and sheet metal submittals with roofing submittals.

C. Shop Drawings: Show layout, profiles, methods of joining, and anchorage details, including major counter flashings, trim units and scuppers. Provide layouts at 1/4-inch scale and details at 3-inch scale.

D. Product Data: Manufacturer's technical data, installation instructions and general recommendations for each product specified. Include data substantiating that materials and performance comply with requirements.

E. Samples: Duplicate Samples of flashing, sheet metal, and accessory items as follows:

1. 8-inch square Samples of specified sheet materials to be exposed as Finished Work.

2. 12-inch Samples of fabricated products exposed as finished Work including Samples of each type of joint. Provide complete with specified factory finish.

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1.5 QUALITY ASSURANCE

A. Referenced Codes and Standards: Comply with the following in accordance with Division 1.

1. NRCA Roofing and Waterproofing Manual by National Roofing Contractors Association

2. Architectural Sheet Metal Manual by Sheet Metal and Air Conditioning Contractor's National Association

B. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

C. Preinstallation Conference: Participate in conference specified in Exterior Enclosure, General: Division 7 and Single-Ply Roofing: Division 7.

D. Inspection and Testing: Inspection and Testing Agency services will be required in relation to Work of this Section.

1.6 DELIVERY, HANDLING AND STORAGE

A. Ship, handle and store material to prevent twisting, bending, denting, abrasion or other damage.

B. Prevent contact with materials which may cause discoloration, staining or damage.

C. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.7 FIELD CONDITIONS

A. Do not perform flashing or sheet metal work involving sealants, mastics, adhesives or other temperature sensitive materials when temperature is lower than recommended in writing by material manufacturer.

B. Do not install flashing or sheet metal over wet or damp substrate.

1.8 SEQUENCING

A. Coordinate installation of Work to allow for embedded or covered items.

Part 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Provide recycled content materials in accordance with Sustainability Action Plan specified in Sustainability Requirements: Division 1.

C. Provide regional materials in accordance with Sustainability Action Plan specified in Sustainability Requirements: Division 1.

D. Use adhesives and sealants that comply with the VOC limits specified in Sustainability Requirements: Division 1.

E. Use field applied paints and coatings that comply with the VOC limits and chemical restrictions specified in Sustainability Requirements: Division 1.

2.2 SHEET METALS

A. Exposed Sheet Metal: Match material and finish of adjacent sheet metal panels specified elsewhere in Division 7. Match gage of adjacent metal panels except provide heavier gage if required by SMACNA for application or for welding.

1. Use for exposed locations where indicated on drawings.

B. Zinc-Coated Steel: Commercial quality with 0.20 percent copper, ASTM A 653/ 653M, G90, mill phosphatized; minimum 26 gage except where heavier gage indicated.

1. Use typically for fully concealed locations or for locations only visible from roof level.

C. Stainless Steel: AISI Type 302/304, ASTM A 167, 2D annealed finish, except where other finish specified; soft except where harder temper required for forming or performance; 22 gauge except where heavier gage indicated.

1. Use typically for all exposed or semi-exposed locations, including, but not limited to all through-wall, head and sill flashing.

2.3 MASONRY FLASHING

A. Thru-wall Flashing: Two-part assembly consisting of stainless steel 22 gage flashing ASTM A 240/A 240M dead soft, fully annealed; with smooth, flat surface and membrane flashing specified below.

2.4 MEMBRANE FLASHING

A. Membrane Flashing Sheets: As specified in Air/Vapor Barriers: Division 7.

B. Self-Adhering Flashing Sheets:

1. Blueskin by Henry/Bakor.
2. Rub-R-Wall SA by Advanced Coatings Inc.
3. Perm-A-Barrier by W.R. Grace.
4. Aqua Flash 500 by Fiberweb.
5. Polyguard 400 by Polyguard Products, Inc.
6. Air-Shield by W.R. Meadows.

C. Self-supporting Flashing Sheets: Uncured neoprene complying with ASTM D 200, Designation 2BC415 to 3BC620, 50 to 65 mils thick.

D. Silicone Flashing Sheets: Pre-cured low-modulus silicone extrusions, combined with neutral-curing low modulus silicone sealant for bonding to substrate, Pecora Sil-Span or Dow Corning 1-2-3.

2.5 ACCESSORIES

A. Fasteners: Same metal as flashing or sheet metal or other non-corrosive metal which will not contribute to galvanic action and as follows:

1. Nails shall be barbed or ring-shank type and penetrate minimum [1 1/4 inch] {31 mm} into substrate.
2. Fasteners into concrete shall be one (1) of the following as suitable to condition:

a. Hardened concrete screws, minimum No. 8's, in predrilled holes.
b. Deformed head, drive-in, compression fit spikes, minimum 3/16-inch diameter in predrilled holes.
c. Explosive set anchors, minimum 1-inch penetration.
d. Epoxy anchors in predrilled holes.
e. Hand driven nails are not acceptable.
f. Lead, fiber or plastic shields or plugs are not acceptable.

3. Exposed fasteners shall be high-domed, capped and neoprene gasketed screws, minimum No. 8's, finish to match adjacent metal.

B. Cleats: Same metal as flashing and minimum two (2) gages heavier, continuous.

C. Clips: Same metal as flashing and minimum two (2) gages heavier. Clips shall be approximately 2 inches wide by 6 inch long strips.

D. Solder: For use with steel or copper, provide 50-50 tin/lead solder per ASTM B 32, with rosin flux.

E. Solder: For use with stainless steel, provide 60-40 tin/lead solder per ASTM B 32, with acid-chloride type flux, except use rosin flux over tinned surfaces.

F. Sealant Concealed Within Sheet Metal Work: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.

G. Exposed Sealant: As specified in Joint Sealants: Division 7.

H. Anticorrosive Paint: SSPC-Paint 20.

I. Roofing Cement: ASTM D 2822, asphaltic.

J. Adhesives: Type recommended in writing by flashing sheet manufacturer for waterproof/weather-resistant seaming and adhesive application of flashing sheet.

K. Foam Tape: 9 pcf density (self-adhesive) foam tape with flame retardants to meet FMVSS 302 flammability standard. "Norseal V 780" by Saint-Gobain. Equivalent products of other manufacturers will be evaluated as substitutions in accordance with requirements of Division 1.

1. Provide 1/8-inch-thick at metal panels, concrete or other smooth substrate.

2. Provide 1/4-inch-thick at masonry or similar rough substrate.

L. Butyl Tape: Preformed 100 percent solids, cross-linked isobutylene tape. "TremPro NGT" by Tremco. Equivalent products of other manufacturer's will be evaluated as substitutions in accordance with requirements of Division 1. Provide 1/8 inch by 1/2-inch tape, unless otherwise indicated.

2.6 FABRICATION:

A. General: Shop fabricated in compliance with approved submittals. Comply with referenced standards except where more stringent requirements are indicated.

1. Extent: Shop fabricate Work to greatest extent possible. Limit field work to minor trimming and installing fabricated pieces except for joints in straight running lengths that have to be made up on Project Site.

2. Fixed Seams:

a. Galvanized Steel and Stainless Steel: Tin edges, form a flat lock seam and solder or provide heavier material and weld lap joint watertight.
b. Aluminum: Form a flat lock seam, fill with epoxy seam sealer and rivet joint or use thicker material and weld butt joint watertight.
c. Welds: Where welds are acceptable, provide material of sufficient thickness to be welded without distortion or burn-through even if a lesser thickness is otherwise allowed. At prefinished or exposed welds, grind smooth and repair finish to match original condition.
d. Clean soldered joints to remove flux immediately after soldering.

3. Moving Seams: Unless other seam types are indicated, lap minimum 4 inches and bed in three (3) rows of polyisobutylene sealant or two (2) rows of butyl tape.
4. Intersections: Shop-fabricate end dams, corners, tees, vertical transitions and other intersections with approximately 12 inches to 18-inches legs to form a single watertight unit.
5. Curves: Shop-fabricated curved flashing and sheet metal by cutting out each curved plane and welding or soldering pieces together to form indicated cross-section true to radius and shape indicated. Do not cut or bend straight sections to short lengths to approximate curve. Do not kink to follow curve.
6. Terminations: Wherever running lengths of flashing or sheet metal terminate at a vertical plane shop-fabricate a watertight end dam approximately 4 inches high. Turn up integral end dam and patch in at outside corners by attaching separate piece using fixed seams.
7. Edges: Hem exposed edges on least visible side approximately 1/2 inch.
8. Separations: Provide for separation of metal from noncompatible metal or corrosive substrates by coating concealed surfaces with anticorrosive paint or other permanent membrane.
9. Fastener Holes: Pre-punch holes for fasteners when thickness of material makes field penetration difficult and where indicated. Provide slotted holes where allowance for expansion and contraction is necessary.

B. Counterflashing: Fabricate counterflashing in two (2) pieces, a receiver and counterflashing leg, to allow future access to base flashing below. Coordinate trades (for example, masonry and mechanical) which may embed receiver portion of counterflashing in their Work. Form counterflashing leg approximately 6 inches 100 mm high and shaped to spring against base flashing.

1. Surface-Mounted Counterflashing Receiver: Fabricate from 16 gage material with slotted holes 12 inches on center.
2. Bottom lip of counterflashing to accept continuous concealed cleat except use concealed clips at surface mounted counterflashing and where counterflashing is backed by membrane flashing.

C. Scuppers: Fabricate from stainless steel sheet to shape with flanges and drips indicated. Where possible, make seams at top of scupper and away from potential water exposure. Scupper box shall be one (1) piece and watertight. Provide an escutcheon at Metal and Masonry penetrations to match color of adjacent material.

D. Pitch Pockets: Not acceptable.

2.7 FINISHING

A. Exposed sheet metal and flashing shall be prefinished to match adjacent metal finishes.

B. Exposed sheet metal and flashing shall have high performance coating specified in Fluoropolymer Coatings: Division 5.

Part 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with Specifications and suitability for installation of flashing. Do not proceed with installation until deficiencies have been resolved.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Starting installation of flashing and sheet metal constitutes acceptance of substrate and no changes on Contract will be allowed if subsequent removal and reinstallation is required in order to access substrate for corrective action.

3.2 PREPARATION

A. Separations: Provide for separation of metal from incompatible metal or corrosive substrates by coating concealed surfaces with anticorrosive paint or other permanent membrane. Separate stainless steel and aluminum from cementitious or treated wood substrates.

B. Embedded Items: Furnish counterflashing receivers, scuppers, reglets, inserts and other items which must be built into other Work to the appropriate trades. Direct proper installation.

C. Priming: Prime surfaces to receive membrane flashing per manufacturer's written instructions.

3.3 INSTALLATION

A. General: Install in compliance with approved submittals. Comply with referenced standards except where more stringent requirements are indicated.

1. Limit field work to minor trimming and installing fabricated pieces except for joints in straight running lengths that have to be made up on Project Site.
2. Seams: Fixed and moving seams shall be as indicated in Article, Fabrication, unless otherwise indicated.
3. Bedding: Bed flanges of Work in a thick layer of roofing cement, polyisobutylene sealant, butyl coated foam tape, or other similar mastic compatible with adjacent construction as required to be watertight.
4. Intersections and Terminations: Install shop-fabricated intersections, corners, transitions and terminations first. Install running lengths of Work between with moving seams as specified.
5. Underlayment: Install per manufacturer's written instructions for primers and seams. Hold underlayment back approximately 1/2 inch from edge of flashing.
6. Cleats: At the bottom edge of counterflashing, copings, fascia and other similar sheet metal pieces, install continuous concealed cleats over 2-inch-wide butyl or foam tape and fasten at approximately 6 inches on center. Locate fasteners close to lower brake of cleat. Make butt joints and corners tight while allowing for movement.

B. Membrane Flashing: Install membrane flashing typically under all sheet metal flashing and where otherwise indicated as recommended by manufacturer. Seal joints, corners and transitions in membrane flashing air and watertight. Wherever top termination of membrane flashing is not at a reglet or counterflashing, provide a termination bar with appropriate anchors at maximum 12 inches on center and sealant.

1. Self-Adhering Flashing Sheets: Use over a continuous substrate. Do not place in contact with silicone sealants. Do not span membrane without support beyond limits recommended by manufacturer. Provide sheet metal flashing for support if necessary, to bridge gaps beyond manufacturer's limits.
2. Self-supporting Flashing Sheets: Use to span open joints and gaps which accommodate movement, typically at building expansion joints, at movement joints between different systems and at control joints within systems. Provide a fold of excess membrane sized to accommodate movement. Anchor continuously on edges with metal termination bars.
3. Silicone Flashing Sheets: Use at transitions to aluminum curtainwall, windows and storefront and other metal systems which use silicone sealant as part of their installation. Provide a fold of excess membrane sized to accommodate movement. Anchor continuously on edges with metal termination bars if not mechanically captured in glazing system.

C. Counterflashing: Provide two (2) piece counterflashing at upper termination of roofing, waterproofing, base flashings and as indicated, including at top of roof curbs which will support self-flashing mechanical equipment.

Secure receiver piece with fasteners approximately 12 inches on center below line of counterflashing. Install and secure counterflashing to receiver with exposed fasteners approximately 18 inches on center.

1. Install surface-mounted counterflashing receiver over 1 inch wide butyl tape and fasten at pre-punched holes.
2. Install counterflashing over terminations and end dams not otherwise covered by subsequent Work.
3. Hook lower edge of counterflashing over continuous concealed cleat except use concealed clips at surface mounted counterflashing and where counterflashing is backed by membrane flashing.
4. Secure counterflashing in reglets with lead or elastomeric wedges and fill with sealant.

D. Masonry Flashing: Install per requirements of this Section and as further defined in Unit Masonry: Division 4.

E. Scuppers: Line opening for scupper with membrane flashing underlayment. Install scupper by bedding flanges in mastic as specified above. Secure anchors through flanges but never through bottom of scupper.

3.4 PROTECTION

A. Clean exposed metal surfaces. Removing substances that might cause corrosion of metal or deterioration of finishes.

B. Clean off excess sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

E. Protection: Protect flashings and sheet metal work during construction to ensure that Work will be without damage or deterioration other than natural weathering at Date of Substantial Completion.

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END OF SECTION 076200

SECTION 077200 ROOF ACCESSORIES

Part 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Applicable Sections: Division 1.

C. Inspection and Testing and of Roofing: Division 1.

D. Exterior Enclosure, General: Division 7.

E. Single-Ply Roofing: Division 7.

F. Flashing and Sheet Metal: Division 7.

G. Joint Sealants: Division 7.

H. Mechanical: Division 23, refer to for equipment mounted on or penetrating roof.

I. Electrical: Division 26, refer to for equipment mounted on or penetrating roof.

1.2 SUMMARY (NON-INCLUSIVE)

A. Section Includes: Accessories required to complete roofing assembly, installation of roofing components specified elsewhere and miscellaneous accessories, as follows:

1. Roof Curbs.
2. Equipment and Ductwork Support Rails.
3. Prefabricated Flashing Boots.
4. Pipe Curb Assemblies.
5. Roof Walkways

B. Products Installed but Not Specified Under This Section.

1. Mechanical: Division 23, refer to for curbs and rails for mechanical equipment.
2. Mechanical and Electrical: Divisions 23 and 26, refer to for roof-top mounted equipment.

1.3 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.4 SUBMITTALS

A. Submit per the requirements of Division 1.

B. Shop Drawings: Coordinate with Roofing Drawings. Each roof accessory shall be located on Roofing Drawing Plan.

1. Expansion Joint Covers: Show extent of expansion joints on plans. Provide plan, section and isometric details at minimum 3 inches equals 1-foot scale for each intersection, termination, corner, transition or any condition other than normal straight run. Details shall be sufficient to allow shop prefabrication of each element.

2. Custom Hatches: Drawings showing all operating features and coordination with adjacent construction.

C. Product Data: For each roof accessory indicated, including accessories, primers and other miscellaneous products.

D. Calculations: For each curb and rail include calculations and manufacturer's certified load bearing data indicating that equipment indicated to bear on curb or rail does not exceed the maximum allowable load for curb or rail.

E. Certifications:

1. Independent certification for fire-rated assemblies.

2. Certifications of compatibility for each roof accessory with roofing system.

F. Sustainability Submittals: Provide the following in accordance with Sustainability Requirements: Division 1.

1. Materials Sustainability Documentation Form.

2. Product data, certification letter, and costs for materials with recycled content.

3. Product data and costs for regional materials.

4. Product data for adhesives and sealants indicating VOC content.

5. Product data for paints and coatings indicating VOC content and chemical composition.

6. Product test reports indicating that roof materials comply with Solar Reflectance Index requirement.

G. Closeout Submittals: Draft of Warranty prior to start of fabrication or construction. Final Warranty after Date of Substantial Completion.

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1.5 DEFINITIONS

A. Refer to Roofing System Specification Section for definitions.

1.6 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Manufacturer of roof accessories shall be acceptable to manufacturer of roofing system.

B. Installer's Qualifications: Installer shall be installer of roofing system as specified elsewhere in Division 7.

C. Single Source Responsibility: Each type of roof accessory shall be product of a single manufacturer.

D. Regulatory Requirements:

1. Roof accessories indicated to be fire-rated shall be labeled by UL or another agency acceptable to jurisdiction having authority.

2. Products shall comply with applicable Volatile Organic Compounds (VOCs) regulations.

E. Certifications: Roofing manufacturer shall certify that each roof accessory is compatible with roofing system and is acceptable for indicated use.

F. Conferences: Manufacturers of roofing accessories shall participate in Preliminary Roofing Conference and Preapplication Roofing Conference specified in Roofing System Specification Section.

1. Coordinate curbs, rails, penetrations and other roof accessories specified in this Section with roof-mounted equipment specified in Divisions 23 and 26.

G. Services of an independent Inspection and Testing Agency will be required in conjunction with Work of this Section.

1.7 DELIVERY, HANDLING AND STORAGE

A. Deliver materials in original unopened containers or packaging clearly labeled with manufacturer's name, brand name, instructions for storage, handling and use, all identifying numbers and UL labels.

B. Store materials on pallets or other similar raised platform and protected from weather.

C. Do not overload structure by storing large amounts of material in one (1) area.

D. Store adhesives and other temperature sensitive materials between 60 degrees F and 80 degrees F.

1.8 FIELD CONDITIONS

A. Substrates to receive roofing accessories shall be broom clean and dry, free of dirt, trash, contaminants, water, dew, frost, ice or snow.

B. Roofing accessories shall be compatible with selected roofing system.

1.9 SPECIAL WARRANTY

A. General: Warranty shall not deprive Owner of rights under other provisions of Contract and shall be in addition to, and run concurrent with, other Warranties made by Contractor under requirements of Contract Documents.

B. Special Warranty: Written Warranty, executed by manufacturer agreeing to repair or replace components of roof hatches (scuttles), that fail in materials or workmanship within five (5) years from Date of Substantial Completion.

C. Correct defects, at no additional cost, within thirty (30) days after notification in writing of failure to meet Warranty. Owner reserves right to use equipment until service or replacement is performed.

D. Tie in of roofing accessories to roof membrane shall be covered under Roofing Warranty.

Part 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Provide recycled content materials in accordance with Sustainability Action Plan specified in Sustainability Requirements: Division 1.

B. Provide regional materials in accordance with Sustainability Action Plan specified in Sustainability Requirements: Division 1.

C. Use adhesives and sealants that comply with the VOC limits specified in Sustainability Requirements: Division 1.

D. Use field applied paints and coatings that comply with the VOC limits and chemical restrictions specified in Sustainability Requirements: Division 1.

2.2 METAL ROOF CURB

A. Curbs shall be factory assembled of galvanized steel sheet Internally reinforced and capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings, bearing continuously on roof structure, and capable of meeting performance requirements; with fully welded corners and integral base plate and as follows:

1. 18 gauge minimum. Provide heavier where required for intended load.
2. Internally reinforce any side over 3 feet long at maximum 3 feet on center with 1 inch by 1 inch by 1/8-inch steel angle.
3. Factory insulate curb with 3 pcf semi-rigid glass fiberboard 1 1/2 inch thick.
4. Curb shall extend from substrate to minimum 8 inches above top of insulation and tapered edge strip.
5. Construct curb to match slope of roof and to provide a level top surface.
6. Line curb with galvanized steel sheet when back of curb is exposed to view in finished Work.
7. Provide curb with decay resistant pressure treated and kiln dried lumber nailers, 1 1/2 inches square.

B. Products: Subject to compliance with requirements, provide products manufactured by one (1) of the following. Equivalent products of other manufacturers will be evaluated as substitutions in accordance with requirements of Division 1.

1. Bilco Co.
2. Custom Curb, Inc.
3. O'Keefe's, Inc.
4. Roof Products & Systems (RPS) Corp.
5. The Pate Co.
6. Thy Curb Division/ThyBar Corp.
7. Approved manufacturer of mechanical equipment being mounted on curb. Refer to Mechanical: Division 23.

C. Fabrication: Shop fabricate each metal roof curb as a completed assembly, ready for installation without additional field assembly.

2.3 EQUIPMENT SUPPORT RAILS

A. Rails shall be factory assembled of galvanized steel sheet with fully welded corners and integral base plate and as follows:

1. 18 gage except use heavier where required for intended load.
2. Internally reinforce at 12 inches on center with alternating full-depth channels and 6 inch spreaders.
3. Curb shall extend from substrate to minimum 8 inches above top of insulation and tapered edge strip.
4. Construct curb to match slope of roof and to provide a level top surface.
5. Provide curb with decay resistant pressure treated and kiln dried lumber nailers, 1 1/2 inches thick and 5 1/2 inches wide.
6. Provide 18 gage galvanized steel counterflashing with fully welded corners.
7. Provide pipe roller supports to suit indicated pipe sizes with inverted galvanized channel, plated threaded rods and roller chair.

B. Products: Subject to compliance with requirements, provide products manufactured by one (1) of the following. Equivalent products of other manufacturers will be evaluated as substitutions in accordance with requirements of Division 1.

1. Bilco Company.
2. Custom Curb, Inc.
3. O'Keefe's, Inc.
4. Roof Products & Systems (RPS) Corporation.
5. The Pate Company.
6. Thy Curb Division/ThyBar Corporation.

C. Fabrication: Shop fabricate each rail as a completed assembly, ready for installation without additional field assembly.

2.4 PREFABRICATED FLASHING BOOTS

A. Shop fabricated with opening designed specifically for penetrating item and base design coordinated with roofing details.

2.5 PIPE CURB ASSEMBLIES

A. Three-part assembly of curb, cover and molded caps.

B. Curb shall be a pre-fabricated box of 18 gage galvanized steel with continuous welded corner seams, [1 1/2 inch} of [3 pound] density rigid fiberglass insulation and a pressure-treated top nailer. Curb shall extend from top of substrate to minimum [8 inches] {200 mm} above top of insulation and tapered edge strips. Provide a multiple curb assembly when required for penetrating elements.

C. Cover shall be an acrylic clad thermoplastic molded to counterflash curb and with a turned up collar for cap. Where more than one (1) cover is required on a curb, provide flashing between covers.

D. Cap shall be molded EPDM with stainless steel drawbands. Select cap to suit size and number of penetrating elements.

E. Provide one (1) of the following: Equivalent products of other manufacturers will be evaluated as substitutions in accordance with requirements of Division 1.

1. "RPS Pipe Portal" by Roof Products and Systems Corp.
2. "Pate Pipe Curb Assembly" by The Pate Company.
3. "Portal System" by Portals Plus, Inc.

2.6 ACCESSORIES

A. Fasteners: Same metal as flashing or sheet metal or other non-corrosive metal which will not contribute to galvanic action and as follows:

1. Nails shall be barbed or ring-shank type and penetrate minimum 1 1/4 inch into substrate.
2. Concrete fasteners shall be one (1) of the following:

a. Hardened concrete screws with corrosion resistant coating, minimum No. 8's, self-tapping in pre-drilled holes.
b. Deformed head, drive-in, compression fit spikes with corrosion resistant coating, minimum 3/16-inch diameter in pre-drilled holes.
c. Explosive set anchors, minimum 1-inch penetration.
d. Driven concrete or masonry nails are not acceptable.
e. Lead, fiber or plastic shields or plugs are not acceptable.

3. Exposed fasteners shall be high-domed, capped and neoprene gasketed screws, minimum No. 8s, finish to match adjacent metal.

B. Flashing and Sheet Metal: As specified in Flashing and Sheet Metal: Division 7.

C. Sealant Concealed Within Sheet Metal Work: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.

D. Exposed Joint Sealant: As specified in Joint Sealants: Division 7.

E. Anticorrosive Paint: SSPC-Paint 20.

F. Roofing Cement: ASTM D 2822, asphaltic.

G. Adhesives: Type recommended in writing by flashing sheet manufacturer for waterproof/weather-resistant seaming and adhesive application of flashing sheet.

H. Foam Tape: 15 pcf density (self-adhesive) foam tape, 1/4 inch by 1 1/2 inch, unless otherwise indicated. "V 770" by Norton and "V1510" by Certainseal. Equivalent products of other manufacturers will be evaluated as substitutions in accordance with requirements of Division 1.

Part 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive roofing accessories for suitability. Do not proceed, unless conditions are acceptable.

B. Deficiencies: Report to the Contractor prior to commencing Work.

C. Acceptance: Commencing Work constitutes acceptance of substrate. Future work or re-work required because of deficient substrates will be performed at no expense to the Owner.

3.2 PREPARATION

A. Isolate dissimilar metals from each other and reactive metals from corrosive substrates with anticorrosive paint.

3.3 INSTALLATION

A. General: Comply with approved submittals and manufacturer's written instructions.

1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.

2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.

3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.

4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

5. Coordinate with installation of roof deck and other substrates to receive accessory units, vapor barriers, roof insulation, roofing and flashing, as required, to ensure that each element of Work performs properly and that combined elements are waterproof and weathertight.

B. Prefabricated Flashing Boots: Mechanically anchor base through insulation into substrate at minimum three (3) points. Install cap, secure drawbands and seal top of cap at penetrating element.

C. Curbs: Set curbs directly onto metal or concrete substrate. Do not set curbs on top of insulation.

1. Where indicated set curbs directly on structural steel frame, not on metal deck. Metal deck shall bear on flange of curb.

2. Anchor curbs to metal substrate with 1/2-inch puddle welds, 1 inch fillet welds or No. 10 self-tapping, self-drilling screws at maximum 12 inches on center.

3. Anchor curbs to concrete substrate with self-tapping concrete screws or expansion anchors maximum 12 inches on center.

4. Counterflash curbs with two-piece counterflashing per Flashing and Sheet Metal: Division 7, unless curb has integral counterflashing.

5. Seal tops of curbs before placing materials or equipment on curbs with continuous foam tape.

D. Pipe Curb Assemblies: Set curbs as indicated. Set cover and caps, secure draw bands and seal top of cap at penetrating element.

E. Roofing Membrane and Base Flashing: Refer to specific Roofing System Specifications: Division 7.

F. Roof walkways pads: Verify that locations of access and servicing points for roof-mounted equipment are served by locations of roof walkways.

3.4 REPAIR AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780/A 780M.

B. Clean exposed surfaces according to manufacturer's written instructions.

C. Clean off excess sealants.

D. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077200

SECTION 078413 FIRESTOPPING

Part 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Applicable Sections: Division 1.

C. Individual Sections specifying assemblies or penetrating items which require firestopping.

D. Plumbing: Division 22

E. Mechanical: Division 23.

F. Electrical: Division 26.

1.2 SUMMARY (NON-INCLUSIVE)

A. Section Includes:

1. Firestopping of through-penetrations,
2. Construction gaps and joints,
3. Wall openings in rated and non-rated assemblies.
4. Penetrations in fire-resistance-rated walls.
5. Penetrations in horizontal assemblies.
6. Penetrations in smoke barriers

1.3 SUBMITTALS

A. Submit per the requirements of Division 1.

B. Shop Drawings: Show materials, design designations, ratings, installation methods, dimensions, and relationships to adjoining construction for each system, construction condition and penetrating item.

1. Floor Plans: Show vertical and horizontal rated assemblies, and smoke barriers.
2. Schedule: Show each type of substrate, type of penetrating item, required fire resistance rating of the substrate, "F", "T" rating of firestopping, design of firestopping system including the type of materials that will be utilized and firestopping design designations.
3. Details: UL Numbered Drawings for each firestopping configuration for construction and penetrating items.
4. Engineering Interpretations: Where Project conditions require modification of a design to suit a particular firestopping condition, submit data signed and sealed by firestopping manufacturer's fire protection engineer.

C. Product Data: For each product or system.

1. Copies of UL listing for each system.

2. Description of materials.

3. Manufacturer's written installation instructions.

D. Qualifications: Data for manufacturers, installers and designers. Include list of completed projects with project names, addresses, names of Design Professionals and Owners, and other information specified.

E. Quality Control Procedures: Field Inspection Reports from manufacturer as indicated.

F. Certifications:

1. Training Certification: From Manufacturer.

G. Sustainability Submittals: Provide the following in accordance with Sustainability Requirements: Division 1.

1. Materials Sustainability Documentation Form.

2. Product data, certification letter, and costs for materials with recycled content.

3. Product data and costs for regional materials.

4. Product data for adhesives and sealants indicating VOC content.

5. Product data for paints and coatings indicating VOC content and chemical composition.

H. Closeout Submittals: Warranty, as indicated.

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1.4 DEFINITIONS

A. Construction Gap: A linear opening in or between adjacent assemblies.

B. Engineering Judgement: Evaluations developed by the manufacturer for new firestop systems similar to approved designs which provide the same or higher level of performance, are suitable for the intended use and are acceptable to the authorities having jurisdiction.

C. Fire Rated: Having the ability to withstand effects of fire for a specified time period, as determined by qualified testing.

D. Fire Rated Assembly: A floor/ceiling, roof/ceiling, wall, or other approved assembly able to withstand a design fire and hose stream test without failure for a specific length of time.

E. Fire Resistance Rating: The time, in hours, for which the rated assembly can withstand effects of fire without burn-through or structural failure.

F. Firestop, Firestopping: Firestop system.

G. Firestop System or Firestop Assembly: Combination of materials and devices, including penetrating items, in conjunction with a specific fire rated assembly and specific penetrating materials (if present) required to achieve an approved rated fire barrier.

H. Through-Penetration: An opening that passes entirely through a fire rated assembly.

I. Penetrating Item: A pipe, duct, conduit, cable tray, cable, or other element passing through an opening in a fire rated assembly.

J. Wall or Ceiling Opening: A penetration of one (1) or more layers or a fire rated assembly that is not a through-penetration, such as an electrical box.

1.5 SYSTEM DESCRIPTION

A. Selection Requirements: Provide each type of firestop system, selected from manufacturers tested assemblies to conform to indicated requirements.

1. Where manufacturer does not have a standard assembly to conform, provide a system acceptable to authority having jurisdiction based on an Engineering Judgement.

1.6 QUALITY ASSURANCE

A. Manufacturer's Qualifications: A firm which has been manufacturing firestopping for minimum five (5) years. Firm shall manufacture a full line of firestopping products including caulks, sealants, putty, wrap strip, composite sheets, mortar, sprays and pipe choke systems. Manufacturer's Engineer shall have minimum five (5) years' experience selecting and engineering firestopping systems.

B. Manufacturer's Technical Field Representative Qualifications: An individual with minimum five (5) years full time experience specializing in selection and application of firestopping systems and certified in writing by manufacturer.

C. Installer's Qualifications: Each individual installer of firestopping shall have completed indicated on-site training program and shall be certified as trained in proper procedures of product installation by Manufacturer's Technical Field Representative.

D. A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

E. Single Source Responsibility: Obtain each type of firestopping system listed below from one (1) manufacturer.

1. Perimeter fire containment systems.
2. Through-penetration firestop systems, except cable-tray systems.
3. Cable-tray through-penetration firestop systems.
4. Joint systems.
5. Wall or ceiling opening protective materials.

F. Regulatory Requirements:

1. Systems shall be UL labeled and listed in UL Fire Resistance Directory as appropriate for their intended use.
2. Comply with applicable State and Local Code requirements.

G. Firestopping sealants and primers must meet or exceed applicable VOC limits of South Coast Air Quality Management District Rule No. 1168 in effect on January 1, 2003 and rule amendments dated October 3, 2003.

H. Field Samples: Install one (1) Sample in field at location approved by Design Professional for each type of firestopping.

1. Notification: Schedule for Project Site observation by Design Professional accompanied by Manufacturer's Technical Representative, Contractor and Owner's Representative.
2. Report: Manufacturer's Field Representative shall certify in writing on letterhead that field samples comply with specified requirements.
3. Protection: Approved Samples shall be labeled and protected through the remainder of Work. Approved Samples shall be incorporated into completed Work.

I. Installer's Training Program:

1. Each installer of firestopping shall be trained and certified in writing by manufacturer prior to starting Work.
2. Manufacturer's Technical Field Representative: Conduct training program on Project Site.

3. Certificates: Manufacturer's Technical Field Representative shall issue a certificate, 8 1/2 inches by 11 inches and wallet size, to each individual installer indicating completion of training program for this Project.

4. Program: Provide written instructions for installation of systems selected for this Project. Provide printed training aids, instructions, manufacturer's contacts and other pertinent information.

J. Preinstallation Conference: Schedule conference approximately two (2) weeks prior to scheduled commencement of firestopping installation and associated Work. Meet at Project Site with Contractor, Subcontractors, and Installers of associated Work including mechanical and electrical Work; Contractor, Firestopping Manufacturer's Representative; and Other Representatives directly concerned with performance of Work including (where applicable) Owner's Insurers, Test Agencies, and Governing Authorities.

1. Review foreseeable methods and procedures related to firestopping work. Tour representative areas where firestopping is to be installed; inspect and discuss each type of condition, each type of substrate encountered, and preparatory Work to be performed under other Sections.

2. Contractor shall record discussion, including agreement or disagreement on matters of significance; furnish copy of recorded discussions to each participant. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for a reconvening conference.

3. Inspection: At discretion of Owner's Representative, Owner will employ and pay for a qualified Inspection and Testing Agency to verify installed firestopping systems for compliance with requirements

1.7 DELIVERY, HANDLING AND STORAGE

A. Deliver firestopping products to Project Site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacturer, lot number, and shelf life, if applicable; UL mark; curing time; and mixing instructions for multi-component materials.

B. Store and handle firestopping materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.8 FIELD CONDITIONS

A. Verify each type of condition and each type of substrate to be encountered.

A. Environmental Requirements: Ambient or substrate conditions as recommended in writing by manufacturers.: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

1.9 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

1.10 SEQUENCING AND SCHEDULING

A. Owner's Inspection Agency: Notify minimum one (1) week in advance of firestopping installations.

B. Inspection: Do not cover or conceal firestopping until Owner's Inspection and Testing Agency and authorities having jurisdiction (if either is required) have inspected and approved installation.

1.11 WARRANTY

A. Warranty: Warrant for a period of three (3) years from Date of Substantial Completion against deterioration or failure in labor or materials.

Part 2 PRODUCTS

2.1 MANUFACTURERS

A. Products of following manufacturers are acceptable to furnish firestopping systems, subject to compliance with indicated criteria. No substitutions.

1. 3M Fire Protection Products.
2. Hilti Inc.
3. Nelson Firestop Products.
4. The Rectorseal Corporation.
5. Specified Technologies, Inc.

B. Products of following Manufacturers are acceptable, subject to compliance with indicated criteria, for specific indicated applications: CSD Sealing Systems, Roxtec, and United States Gypsum Company.

2.2 MATERIALS

A. Use adhesives and sealants that comply with the VOC limits specified in Sustainability Requirements: Division 1.

B. Use paints and coatings that comply with the VOC limits and chemical restrictions specified in Sustainability Requirements: Division 1.

C. General:

1. Cold Smoke Seals: Seal against cold smoke and gases without requiring materials to be exposed to heat or flame.
2. Water Leakage: Firestopping systems in floor/ceiling and roof/ceiling assemblies or when exposed to the exterior in the finished construction shall have a W-rating of Class I when tested in accordance with UL Water Leakage Test under ANSI/UL 1479.
3. Sealing Materials:
   a. Flexible in cured or set state to allow for minimum plus-or-minus 25 percent movement without detrimental effect.
   b. Comply with ASTM C 920, type, grade, and class to suit location.
4. Asbestos-free in accordance with 40 CFR, Part 763, Subpart F, Appendix A, Section 1 "Polarized Light Microscopy".
5. Compatibility: Materials compatible with substrate, penetrating material and other contacting materials.
6. Firestopping Pillows: Not acceptable.

7. Mortar or Fibrous Fill Systems: Not acceptable without an elastomeric sealant, except at systems with an appropriate "L" rating.

8. Volatile Organic Compounds (VOCs) Compliant.

9. Firestopping exposed to view, traffic, moisture, and physical damage: Products that do not deteriorate when exposed to these conditions.

   a. Plumbing and Wet-Pipe Sprinkler Systems: Moisture-resistant through-penetration firestop systems.
   b. Floor penetration with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic: Systems capable of supporting floor loads involved.

10. Insulated Piping: Systems not requiring removal of insulation.

11. Combustibility: Flame-spread values of less than 25 and smoke-developed values of less than 450, as determined per ASTM E 84.

D. Through-Penetration Firestops, except cable-tray systems:

1. F-Rating: Equal to or exceeding the fire rating of penetrated assembly.

2. T-Rating: Equal to or exceeding fire rating of penetrated assembly in the following locations:

   a. Where penetration is not concealed in a wall cavity.
   b. Where penetration is not concealed in a shaft.
   c. Where penetration is located in an assembly required to have doors with a temperature-rise rating.
   d. Where penetrating item is larger than 4 inch nominal pipe diameter or [16 square inches] {0.01 square meter} in cross-sectional area.

E. Cable Tray Through-Penetration Firestop System: Resealable system complying with criteria above, utilizing a two (2) piece flanged metal enclosure, intumescent sponge, mineral wool and sealant. Provide products of CSD Firestop by CSD Sealing Systems.

F. Joint Systems:

1. Rating: Equal to or exceeding fire rating of adjacent assembly.

2. Joints systems at edges of unrated floor/ceiling assemblies: Minimum one (1) hour.

3. United States Gypsum Products are approved in addition to previously specified manufacturers.

G. Wall or Ceiling Opening Protective Materials:

1. Rating: Equal to or exceeding fire rating of adjacent assembly.

2. Firestopping used as draftstopping at head of partitions which do not extend to structure above: minimum one (1) hour.

H. Sleeves: As specified in Divisions 23 and 26 for penetrating items included in those Sections. Unless otherwise indicated, provide manufacturer's written recommended sleeve.

I. Accessories: Components required for each firestopping system to comply with specified criteria and as required in writing by manufacturer.

2.3 MIXING

A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

Part 3 EXECUTION

3.1 EXAMINATION

A. Substrate: Examine for compliance with requirements affecting performance of firestopping.

B. Corrections: Do not proceed with installation until unsatisfactory conditions have been corrected.

C. Acceptance: Commencing installation constitutes acceptance of substrate.

3.2 PREPARATION

A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.

2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.

3. Remove laitance and form-release agents from concrete.

B. Priming: As recommended in writing by manufacturer. Confine primers to areas of bond.

C. Masking: Prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of Work.

3.3 INSTALLATION

A. General: Comply with approved submittals.

B. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

C. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

D. Install fill materials by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.

2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.

3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

E. Sealant Materials:

1. General: Comply with ASTM C 1193.

2. Joint Fillers and Backers: Support sealants at position to allow optimum movement capability and develop required fire rating.

3. Sealant: Install sealants to directly contact and fully wet joint substrates, fill recesses, and provide proper and uniform cross-sectional shapes and depths. Install sealants at same time joint fillers are installed.

4. Tooling: Tool immediately after sealant application and prior to skinning or curing. Form smooth, uniform beads, eliminate air pockets, and ensure adhesion of sealants with sides of joint. Remove excess. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved in writing by sealant manufacturer.

3.4 INSTALLING FIRESTOP SYSTEMS

A. Install joint systems at each listed location:

1. Perimeter construction gaps and field joints in rated wall assemblies and smoke barriers.
2. Perimeter construction gaps and field joints in all floor/ceiling assemblies, rated and non-rated.
3. Perimeter construction gaps and field joints in rated roof/ceiling assemblies.

B. Install through-firestop systems at each penetration through fire rated assemblies and smoke barriers except as otherwise indicated.

1. Install through-firestop systems at each penetration through top member of partitions that do not extend to underside of structure to provide draftstopping.
2. Install through-firestop systems at each penetration of five-sided gypsum wallboard boxes surrounding elements recessed in rated partitions.

C. Install opening protective materials over each wall or ceiling opening in a fire rated assembly including, but not limited to, boxes for electrical, communication, data, control and instrumentation unless specifically exempted by code authority having jurisdiction.

3.5 FIELD QUALITY CONTROL

A. Independent Inspection:

1. An independent Inspection Agency will examine completed firestopping to determine whether it is installed in compliance with requirements.
2. Inspection Agency will report observations promptly and in writing to Contractor and Design Professional.
3. Do not proceed to enclose firestopping with other construction until reports of examinations are issued.
4. Where deficiencies or non-compliances are found, repair or replace firestopping so that it complies with requirements at no additional cost.

B. Manufacturer's Technical Field Representative shall visit Project Site weekly to inspect installed systems and installation procedures. Representative shall verify that each installer performing Work has completed project training program. Representative shall check that only approved materials and systems are being installed. Submit written Field Inspection Reports.

3.6 PROTECTION

A. Protect firestopping during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so that they are without deterioration or damage at Date of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping immediately and install new materials to produce firestopping complying with specified requirements.

3.7 CLEANING

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

END OF SECTION 078413

SECTION 079200 JOINT SEALANTS

Part 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Applicable Sections: Division 1.

C. Dimensional Stone: Division 4.

D. Firestopping: Division 7.

E. Exterior Enclosure, General: Division 7.

F. Mechanical: Division 23, refer to for packing and sealing within pipe sleeves for mechanical work.

G. Mechanical: Division 23, refer to for packing between metal ductwork and wall, floor, ceiling penetrations.

H. Electrical: Division 26, refer to for packing and sealing within sleeves for electrical work.

1.2 SUMMARY (NON-INCLUSIVE)

A. Section Includes: Joint sealing at the following locations:

1. Joints exposed to weather in Finished Work.
2. Joints not exposed to weather, but visible in Finished Work, except tight joints between smooth materials.
3. Expansion joints and control joints, except where indicated or specified to be covered or made tight elsewhere.
4. Where required to make joints weathertight.
5. Joints between items of equipment and other construction.
6. Joints between plumbing fixtures and other construction.
7. Acoustical sealant work.
8. Where indicated and as otherwise required by Project conditions.

B. Joint sealant work specified as Work of other Sections, but required to comply with provisions of this Section, includes:

1. Sealant work internal to and immediately abutting Metal Roofing and Metal Siding, and internal to flashing and sheet metal work specified in Division 7.
2. Sealant work internal to doors, windows, storefront and curtainwall, and butt joint and structural glazing specified in Division 8.
3. Acoustical sealant work in gypsum wallboard specified in Division 9.
4. Joint sealants in tile work specified in Division 9.

1.3 SUBMITTALS

A. Submit per the requirements of Division 1.

B. Product Data: Manufacturer's Product Specifications, handling, installation and curing instructions, for each product specified. Include manufacturer's written instructions for required cure time for inner line of sealant where double lines of sealant are indicated.

C. Samples: (For the following purposes):

1. Initial Selection: Manufacturer's standard bead. Samples consisting of strips of actual products showing full range of colors available, for each product exposed to view.

2. Verification: Samples of each type and color of joint sealant required. Furnish joint sealant Samples formed with 1/2-inch-wide joints between two (2) 6 inch long strips of material matching appearance of exposed surfaces adjacent to joint sealant in Work.

D. Quality Control Procedures:

1. Test Reports:

a. Manufacturer's certified compatibility, nonstaining, and adhesion test reports for elastomeric sealants indicating that materials forming each joint substrate and joint backing have been tested for compatibility, nonstaining, and adhesion with proposed joint sealant.
b. Manufacturer's written interpretation of test results relative to product performance and recommendations for primers and substrate preparation needed to obtain adhesion.

E. Certifications: Manufacturer's written certification for each joint system including the following: Describe each joint system including each combination of substrates, sealants, backers, accessories, and joint profiles.

1. Each product to be furnished complies with Contract Documents.

2. Each product and system is recommended and approved in writing by manufacturer for intended application indicated, and lists requirements for primers, backers and accessories.

3. Each product and system is compatible with other materials in joint system and substrate.

4. Each product and system is Volatile Organic Compounds (VOCs) compliant as indicated and required.

F. Sustainability Submittals: Provide the following in accordance with Sustainability Requirements: Division 1.

1. Materials Sustainability Documentation Form.

2. Product data, certification letter, and costs for materials with recycled content.

3. Product data and costs for regional materials.

4. Product data for adhesives and sealants indicating VOC content.

G. Closeout Submittals: Special Warranty, as indicated.

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1.4 DEFINITIONS

A. Joint sealants: "Caulk", "caulking", and "sealant" are synonymous, and mean "Joint Sealants" as indicated.

B. "Joints" include interfaces between general construction materials, and exposed interfaces between mechanical and electrical materials and other materials where mechanical and electrical work penetrates walls and floors, except where such penetrations are indicated to be covered and made tight by flanges, gaskets, escutcheons or similar devices.

C. Exposed: Joints exposed to view in Finished Work.

D. Concealed: Joints concealed from view in Finished Work.

E. Exterior: Joints at exterior surfaces of building, whether or not directly exposed to weather.

F. Interior: Joints at interior surfaces of building and not exposed to weather.

G. Paving: Joints in floors, sidewalks, steps, ramps, curbs, and other traffic surfaces.

1.5 QUALITY ASSURANCE

A. Installer shall have successfully completed within last three (3) years at least three (3) applications similar in type and size to this Project and shall assign mechanics from referenced applications, of whom one (1) shall serve as lead mechanic.

B. Obtain materials only from manufacturers who shall, if requested, send a qualified Technical Representative to Project Site to advise Installer of proper procedures and precautions for use of materials.

C. Single Source Requirements: Supply each type of sealant required for Work from one (1) manufacturer. Accessory products including, for example, backers, bond breakers and primers may be from other than primary manufacturer if approved in writing by primary manufacturer.

D. Project Mock-up: Install approved sealants in mock-up specified in Exterior Enclosure, General: Division 7.

E. Field Sample: Provide field sample for control joints in stone paving.

1. Intent: Mock-up shall establish acceptable levels of craftsmanship, quality and appearance.

2. Location: Built-into Work for inclusion in final Project. On Project Site at location directed by Contractor.

F. Referenced Codes and Standards: Comply with the following in accordance with Division 1.

1. ASTM International (ASTM)

C 790	Standard Guide for Use of Latex Sealants
C 804	Practices for Use of Solvent-Release Type Sealants
C 919	Practices for Use of Sealants in Acoustical Applications
C 1193	Guide for Use of Joint Sealants

2. Sealants: Professionals' Guide by Sealant, Waterproofing & Restoration Institute

G. Inspection and Testing: Services of an Inspection and Testing Agency are required in conjunction with Work of this Section. Refer to Division 1.

1. Do not cover Sealant Work that is to be inspected or tested, including but not limited to the inner line of double lines of sealant, until directed.

1.6 DELIVERY, HANDLING AND STORAGE

A. Packing, Shipping: Ship in labeled containers indicating compliance with specified criteria, storage and environmental conditions and installation instructions.

B. Handling and Storage: Comply with manufacturer's written recommendations.

1.7 FIELD CONDITIONS

A. Environmental Requirements: Perform Work under climatic conditions recommended in writing by material manufacturer.

B. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F

2. When joint substrates are wet.

3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.

4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

C.

1.8 SPECIAL WARRANTY

A. Warrant Work to be waterproof, windproof, and dustproof for a period of five (5) years following Date of Substantial Completion. Repairs or replacements required during this period shall be at no additional cost.

Part 2 PRODUCTS

2.1 SEALANTS

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Colors: For each of sealant types listed, provide colors as indicated. Manufacturer's full line of colors shall be all colors published in promotional literature without regard to cost.

1. General Use Weatherproofing Sealants: Two (2) colors selected from manufacturer's full line.

2. Paving and Floor Sealants: One (1) colors selected from manufacturer's full line.

3. Interior Sealants: Two (2) colors selected from manufacturer's full line.

C. Use adhesives and sealants that comply with the VOC limits specified in Sustainability Requirements: Division 1.

D. General Use Weatherproofing Sealants:

1. Type 1: Not Used.

2. Type 2: Silicone, single-part, non-sag, neutral cure, ASTM C 920, Type S, Grade NS, Class 50, for Use NT.

a. Acceptable Products:

1) Dow Corning Corporation; "790" and "795".

a) Do not use "795" with porous substrates.

2) GE Advanced Materials; "SilPruf SCS 2000".

3) Pecora Corporation; "864 NST", "890 NST" or "895 NST".

4) Tremco; "Spectrem 1", "Spectrem 2", or "Spectrem 3".

3. Type 3: Not Used.

E. Paving and Floor Sealants:

1. Type 4: Not Used.

2. Type 5: Silicone, one-part, self-leveling and non-sag, for traffic use, ASTM C 920, Grade P or Grade NS, Class 25 (FS TT-S-227E, Class A, Types I and II).

a. Acceptable Products: Self-leveling listed first, non-sag in parentheses:

1) Dow Corning Corporation; "SL Parking Structure Sealant",

2) Pecora Corporation; "300 SL" or "310 SL", ("301 NS" or "311 NS").

3. Type 6: Not Used.

F. Interior Sealants:

1. Type 7: Silicone, single-part, mildew-resistant, acid or neutral cure, for non-traffic use, USDA/FDA compliant, ASTM C 920, Type S, Grade NS, Class 25 for Use NT.

a. Acceptable Products:

1) Dow Corning Corporation; "786 Mildew Resistant".

a) Do not use with porous substrates.

2) General Electric Company; "Sanitary SCS 1700".

a) Do not use with porous substrates.

3) Pecora Corporation; "898".

2. Type 8: Acrylic Latex, ASTM C 834.

a. Acceptable Products:

1) Bostik, Inc.; "Chem-Calk 600".

2) Pecora Corporation; "AC-20+".

3) Tremco; "Tremflex 834".

3. Type 9: Acoustical sealant, concealed, non-drying, non-hardening, non-skinning, non-staining, gun-grade, synthetic rubber sealant for sealing interior concealed joints to reduce transmission of airborne sound.

a. Acceptable Products:

1) Pecora Corporation; "AC-20 FTR" or "AIS-919".

2) USG, "Sheetrock Acoustical Sealant".

2.2 PRIMERS

A. Non-staining, compatible with sealer and substrate, and manufactured or recommended in writing by sealant manufacturer. Comply with specified VOC requirements.

2.3 JOINT BACKING (BACKER ROD)

A. Preformed compressible, resilient, nonwaxing, nonextruding, nonstaining strips, polyethylene foam, closed cell sponge neoprene, urethane foam, or neoprene, butyl or EPDM tubing, ASTM D 1056, as recommended in writing by sealant manufacturer. Backing shall be of sizes and shapes to control sealant depth and otherwise contribute to optimum sealant performance, sized to suit various conditions, and shall be compatible with sealant, primers and substrates.

2.4 BOND BREAKER

A. Polyethylene or other plastic tapes as recommended in writing by sealant manufacturer for preventing bond between sealant and materials at back (3rd) surface of joint.

2.5 MISCELLANEOUS MATERIALS

A. Provide masking type and cleaning agent as recommended in writing by sealant manufacturer. Cleaners shall be free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates

Part 3 EXECUTION

3.1 GENERAL

A. Each joint sealant system shall include cleaning of joints, priming where required, backing as specified, masking along both sides of joints where required, bond-breaker where conditions of joints require, and finish sealing with type of material specified.

B. Comply with approved submittals and manufacturer's written requirements.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EXAMINATION

A. Project Site Verification of Conditions:

1. Substrates: Examine for conformance to requirements indicated for that substrate.
2. Existing Substrates: Examine for conditions that adversely affect execution of Work and that are not included in indicated repair and patching.

B. Conditions: Report unsatisfactory conditions to Contractor prior to commencing Work.

C. Corrections: Make corrections to substrates prior to commencing Work at no additional cost. Perform corrections as directed by Contractor.

D. Acceptance: Provide rework required because of installation over deficient or defective substrates at no additional cost to the owner.

3.3 SCHEDULE OF SYSTEMS

A. Exterior joints, and interior side of exterior curtainwalls and storefront, unless otherwise indicated: Type 2.

B. Joints In Paving:

1. Exterior: Type 5; pourable type allowed where gradients are 3 percent or less.
2. Interior: Type 5 except in spaces noted on Finish Schedule as Sanitary (SAN): Type 7 except joints indicated to be filled in specification for overlying finish.

C. Interior Work, other than interior side of exterior curtainwalls or window walls:

1. Toilet rooms, shower rooms, janitor closets and similar damp areas: Type 7.
2. Concealed, except acoustic: Type 8.
3. Concealed, acoustic: Type 9.

3.4 PREPARATION

A. Cleaning: Clean joints of loose particles, dust, and other materials detrimental to adhesion.

B. Masking: Mask edges of joints to prevent misplacement of primer or sealant onto adjacent exposed surfaces.

C. Priming: Apply primer as recommended in writing by sealant manufacturer, to dry surfaces prior to application of joint backing, bond-breaker or sealants.

D. Surface Preparation: At substrates with pinholes, pock marks, honeycombing or other similar surface irregularity including, but not limited to, cast-in-place concrete, pre-cast concrete, cast stone, or open textured stone, pre-fill with a skim coat of sealant tooled to fill irregularities.

E. Joint Backing:

1. Install where indicated and in joints where depth of joint exceeds required depth of sealant.
2. Install to provide backing and uniform depth of sealant.
3. Install with approximately 30 percent compression.
4. Do not stretch, twist, puncture or tear joint backing.
5. Butt joint backing at intersections.

F. Bond Breaker: Install bond breaker smoothly at back of joint to eliminate three-sided adhesion where joint backing cannot be installed.

3.5 INSTALLATION

A. Sealant Application: Apply sealant in accordance with manufacturer's written instructions and referenced standards, using hand guns or pressure equipment with proper nozzle size. Force sealant into and against sides of joint. Avoid pulling of sealant from sides. Fill joint completely with sealant.

B. Install weep tubes at spacing recommended in writing by window and skylight manufacturers and as indicated for sealant work at window sill framing, base of curtainwall framing, skylight framing and storefront sill framing, as a part of sealant work. Do not apply sealant in or block weep holes.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Tooling:

1. Typical Joints: Tool exposed surfaces to compress sealant to concave joint configuration in accordance with ASTM C 1193, Figure 8A.
2. Horizontal Joints: Tool to provide a slight wash.
3. Recessed Joint: Tool to configuration in accordance with ASTM C 1193, Figure 8C.
4. Joints shall be straight, uniform, smooth and neatly finished.
5. Tooling agents shall only be used as recommended in writing by sealant manufacturer.

E. Double Line of Sealant:

1. Sequencing: Install inner line, allow curing, and obtaining approval from Independent Testing and Inspection Agency before installing outer line of sealant.
2. Maintain a minimum 1/2-inch cavity between inner and outer lines of sealant and backers.

3. Where cavity between lines of sealant is interrupted, continue inner line to seal bottom of cavity and weep to exterior. Stop the outer line of sealant short a minimum 1/2 inch at the bottom of the cavity and connect the two lines of sealant at the top to create a pressure-equalizing chamber.

F. Pour self-leveling traffic grade sealants in horizontal joints to 1/16 inch below adjoining surface, except where other level shown.

G. Against rough surfaces or in joints of uneven widths, locate sealant back into joint to avoid appearance of excess sealant.

H. Special Sealing: Seal every joint using Sealant Type 7 within materials and intersections of different materials and joints at or between fixed equipment at spaces indicated on Finish Schedule as Sanitary (SAN). Coordinate with work of Divisions 23 and 26 to provide special sealing around mechanical and electrical equipment.

1. Sealant installation shall create continuous, washable and vermin proof joints.

3.6 CLEANING

A. Strip off protective masking tape immediately after compound has been applied. Strip toward joint. Do not reuse masking material. Discard tape carefully to prevent defacing adjacent surfaces.

B. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.7 PROTECTION AND REPAIR

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

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END OF SECTION 079200

SECTION 079500 EXPANSION CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior wall and roof expansion control systems.
2. Interior expansion control systems.

B. Related Requirements:

1. Section 018316 "Exterior Enclosure General Requirements" for additional requirements related to the building enclosure including but not limited to:

   a. Performance and design requirements for the exterior building enclosure.
   b. Coordination of Work required to complete the Exterior Enclosure
   c. Quality Assurance and Control procedures required for the work of the Exterior Enclosure.
   d. Exterior Enclosure Mock-ups including Pre-Construction Mock-ups.
   e. Independent inspection and testing required to verify performance of the work of this section.

2. Section 079200 "Joint Sealants" for liquid-applied joint sealants.

1.2 ACTION SUBMITTALS

A. Shop Drawings: For each expansion control system specified. Include plans, elevations, sections, details, splices, blockout requirement, attachments to other work, and line diagrams showing entire route of each expansion control system. Where expansion control systems change planes, provide isometric or clearly detailed drawing depicting how components interconnect.

B. Samples: For each exposed expansion control system and for each color and texture specified, full width by 12 inches long in size.

C. Samples for Initial Selection: For each type of expansion control system indicated.

1. Include manufacturer's color charts showing the full range of colors and finishes available for each exposed metal and elastomeric seal material.

D. Assembly Samples for Verification: For each typical intersection of expansion control system indicated, submit a full size assembly with each individual leg extending 24 inches from intersection.

E. Product Schedule: Prepared by or under the supervision of the supplier. Include the following information in tabular form:
1. Manufacturer and model number for each expansion control system.
2. Expansion control system location cross-referenced to Drawings.
3. Nominal joint width.
4. Movement capability.
5. Classification as thermal or seismic.
6. Materials, colors, and finishes.
7. Product options.
8. Fire-resistance ratings

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each fire barrier provided as part of an expansion control system, for tests performed by a qualified testing agency.

B. Adhesion and Compatibility Testing: Provide test reports for silicone sealant per requirements of 079210.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. General: Provide expansion control systems of design, basic profile, materials, and operation indicated. Provide units with capability to accommodate variations in adjacent surfaces.

1. Furnish units in longest practicable lengths to minimize field splicing. Install with hairline mitered corners where expansion control systems change direction or abut other materials.
2. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion control systems.
3. Select profiles for joint configuration

B. Coordination: Coordinate installation of exterior wall and roof expansion control systems with roof expansion control systems to ensure that wall transitions are watertight.

2.2 EXPANSION CONTROL SYSTEMS

A. Nominal Joint Width: As indicated.

B. Pre-Compressed Foam Expansion Joint (EJ-FE)

1. Wall-to-Wall, Soffit-to-Wall:
2. Basis-of-Design Product: Emseal Emshield WFR2
3. Silicone Sealant: Provide matching silicone sealant for field seals. Comply with requirements of 079210.

C. Expansion Joint Secondary Seal (EJ-S)

1. Looped Membrane under Primary Expansion Joint
2. 60 mil EPDM.

D. Bellows Expansion Joint (EJ-FR1)

1. Roof to Wall:
2. Basis-of-Design Product: Construction Specialties, BRJW Series
3. Silicone Sealant: Provide matching silicone sealant for field seals. Comply with requirements of 079210.

E. Bellows Expansion Joint (EJ-FR2)

1. Roof to Roof:
2. Basis-of-Design Product: Construction Specialties, BRJ Series
3. Silicone Sealant: Provide matching silicone sealant for field seals. Comply with requirements of 079210.

D. Expansion Joint Gasket (EJ-GW)

1. Wall-to-Wall, Ceiling:
2. Basis-of-Design Product: MM Systems FSW Series
3. Silicone Sealant: Provide matching silicone sealant for field seals. Comply with requirements of 079210.

E. Expansion Joint Gasket (EJ-GF)

1. Floor to Floor:
2. Basis-of-Design Product: MM Systems FS Series
3. Silicone Sealant: Provide matching silicone sealant for field seals. Comply with requirements of 079210.

2.3 FABRICATION

A. Directional changes and terminations to be provided by factory-manufactured assemblies that preserve continuity of seal. Fabricate to extent to require only straight running joints for field work.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces where expansion control systems will be installed for installation tolerances and other conditions affecting performance of work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to expansion control system manufacturer's written instructions.

3.3 INSTALLATION

A. Comply with manufacturer's written instructions for storing, handling, and installing expansion control systems and materials unless more stringent requirements are indicated.

B. Install pre-fabricated corners, transitions, and fittings. Field fabrication is not allowed.

C. Make up straight butt joints between running lengths and fittings per manufacturer's instructions.

D. Install inner seal of expansion joint in addition to outer roof cover. Fill with semi-rigid insulation.

E. Terminate exposed ends of expansion control systems with factory-fabricated termination devices.

F. Provide additional compatible sealant joint between corners of wall seal and the adjacent wall

3.4 PROTECTION

A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

B. Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over expansion control systems. Reinstall cover plates or seals prior to Substantia Completion of the Work.

END OF SECTION 079500

SECTION 081113 **STANDARD HOLLOW METAL DOORS AND FRAMES**

Part 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Applicable Sections: Division 1.

C. Wood Doors: Division 8.

D. Finish Hardware: Division 8.

E. Painting: Division 9.

1.2 SUMMARY (NON-INCLUSIVE)

A. Section Includes: Flush steel doors and pressed steel frames.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 COORDINATION

A. Coordinate Work of this Section with Work in which hollow metal work is to be installed.

B. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

C. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

D. Coordinate hardware installation with opening construction. Hardware is specified in Finish Hardware: Division 8.

1.5 SUBMITTALS

A. Submit per the requirements of Division 1.

B. Shop Drawings: Indicate fabrication and installation of each door and frame. Show elevations of each frame and door type. Show details of construction, installation, connections, anchors, reinforcement, hardware preparation and floor and threshold clearances.

C. Product Data:

1. For each component or material required including accessories, anchors, and other miscellaneous products including data substantiating compliance with Specifications.

2. Schedule: Show each door and opening, unique for actual location, using room number, and sub number if more than one door or opening per room. Show, as a minimum, the same information as on schedule included herein. Show hardware group on schedule.

   a. Provide one schedule for the entire project, coordinate schedule for doors and openings of materials specified in other sections.

D. Sustainability Submittals: Provide the following in accordance with Sustainability Requirements: Division 1.

1. Materials Sustainability Documentation Form.

2. Product data, certification letter, and costs for materials with recycled content.

3. Product data and costs for regional materials.

1.6 QUALITY ASSURANCE

A. Manufacturer's Qualification: Manufacturer shall have minimum five (5) years' experience producing products similar to those required for this Project. Manufacturer shall have documented experience of successfully providing products for three (3) projects of scope, schedule and complexity similar to this Project within last two (2) years.

1. Manufacturer shall currently be a member in good standing of SDI and shall have been so for previous three (3) years. Submit membership certification.

2. Submit qualifications on manufacturer's letterhead. Include project descriptions with Owner and Design Professional contacts for previous experience.

B. Single Source Requirements: All doors and frames required for Work of this Section shall be supplied by one (1) manufacturer. Accessory products including fasteners and anchors may be from other than primary manufacturer if approved in writing by primary manufacturer.

C. Regulatory Requirements: Comply with the following per Division 1.

1. Fire Rated Assemblies: Units shall comply with NFPA 80, shall be identical to assemblies whose fire resistance characteristics have been determined in accordance with ASTM E 152, and shall be labeled and listed by Underwriters Laboratories, Inc. (UL), Warnock Hersey, Inc. (WHI) or other Inspection and Testing Agency acceptable to code authorities having jurisdiction.

   a. Rate of rise for indicated doors shall be a maximum transmitted temperature end point of not more than 250 degrees F above ambient at end of 30 minutes of standard fire test exposure.
   b. Installed Door and Frame Assembly: Shall conform to NFPA 80 for fire rated class indicated.

2. Conform to requirements of ANSI A 117.1, unless otherwise indicated.

D. Referenced Codes and Standards: Comply with the following in accordance with Division 1.

1. Door Hardware Institute (DHI)

   The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder's Hardware

2. Steel Door Institute (SDI), SDI-100 "Recommended Specification Standard Steel Doors and Frames"

1.7 DELIVERY, HANDLING AND STORAGE

A. Deliver clearly labeled, undamaged materials in a timely manner to allow for minimum storage time at Project Site.

B. Deliver doors and frames palleted, wrapped or crated to protect from damage.

C. Break seal of packaging to permit ventilation. Remove any wet or damp packaging.

D. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

E. Store materials on planks or dunnage in a clean, dry location, protected from weather and abuse. Store doors in a vertical position, spaced by blocking to permit air circulation.

Part 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers shall comply with all specified qualifications and be capable of providing products complying with all specified criteria.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: Commercial-quality, level, carbon steel complying with ASTM A 1008/ A1008M.

B. Hot-Rolled Steel Sheet and Strips: Commercial-quality carbon steel, pickled and oiled, complying with ASTM A 1011/ A1011M, free of scale, pitting or surface defect.

C. Galvanized Steel Sheet: Hot-dipped galvanized, carbon steel, commercial-quality, complying with ASTM A 924 or ASTM A 653 with G60 coating, mill phosphatized.

D. Inserts, Bolts and Fasteners: Manufacturer's standard units, hot-dipped galvanized complying with ASTM A 153, Class C or D, where frame is galvanized.

E. Primer: Rust-inhibitive paint complying with ANSI A224.1, "Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames."

F. Glazing: Refer to Glazing: Division 8.

2.3 DOORS

A. General:

1. Doors shall be of types and sizes indicated, with no visible seams, joints, welds or dimples on their faces.
2. Minimum Door Thickness: 1 3/4 inch.
3. Vertical Edge Profiles:
4. Single-acting Swing Doors: Beveled 1/8 inch in 2 inches.
5. Top and Bottom Edges: Close with a continuous recessed steel channel, extending full width of door and spot welded to both faces.
    a. Flush Closure: Close to provide flush, waterproof seal by addition of welded inverted channel at exterior doors.

B. Interior Doors: Fabricate from two (2) outer cold-rolled, stretcher-leveled steel sheets, to comply with SDI Grade II, Models 1 or 2 minimum 18 gage.

1. Core Material: Manufacturer's standard steel stiffeners, insulation, unitized steel grid or rigid mineral fiber core, with sound deadener on insides of face sheets where appropriate.

C. Exterior Doors: Fabricate from two (2) outer cold-rolled, stretcher-leveled steel sheets, to comply with SDI Grade II, Models 1 or 2 minimum 18 gage.

1. Core Material: Manufacturer's standard steel stiffeners, insulation, unitized steel grid or rigid mineral fiber core, with sound deadener on insides of face sheets where appropriate.

D. Hardware Reinforcements:

1. Mortise, reinforce, drill and tap at factory for fully templated hardware in accordance with Hardware Schedule and templates provided per Finish Hardware: Division 8.
2. Reinforce at factory for surface-mounted hardware.
3. Minimum gages and sizes per Steel Door Institute (SDI).

E. Astragals:

1. Interior Doors: Plain design, surface-mounted and continuously welded to edge of active leaf.
2. Interior Doors: Overlapping rabbet formed into edge of door.

2.4 HOLLOW METAL PANELS

A. Hollow metal panels shall be fabricated of same materials and constructed and finished in same way as specified for hollow metal doors.

1. Edge Detail Between Flush Doors and Panels: Plain design, surface-mounted plate continuously welded to panel.

2.5 HOLLOW METAL FRAMES

A. Interior Openings: Form from commercial-quality, cold-rolled steel. Minimum 16 gage.

B. Design and Construction:

1. Form frames into units with integral trim of sizes and profiles indicated.
   a. Fabricatef rames with welded mitered corners. Knock-down frames will not be accepted.
2. Grind, fill and dress welds to be invisible and provide a flush, smooth surface.
3. Multiple or Special Openings: Mullion and rail members shall be closed tubular shapes having no visible seams or joints. Joints shall be welded and finished smooth.
4. Dust Cover Boxes (or Mortar Guards): Provide minimum 26 gage steel boxes at hardware mortises on frames to be set in masonry or plaster partitions.

C. Hardware Reinforcements:

1. Mortise, reinforce, drill and tap at factory for fully templated hardware in accordance with Hardware Schedule and templates provided per Finish Hardware: Division 8.
2. Reinforce at factory for surface-mounted hardware.
3. Minimum hardware reinforcing as recommended in writing by Steel Door Institute (SDI).

D. Floor Anchors:

1. Welded inside each jamb with two (2) holes for floor anchorage.
2. Minimum Thickness: 18 gauge.

E. Jamb Anchors:

1. Frames for Installation in Stud Partitions: Welded steel anchors of suitable design, not less than 18 gauge.
2. Anchors Required in Each Jamb of Welded Frames: One (1) anchor at or aligned with each hinge.

a. Frames over 42 inches wide: Two (2) anchors plus one (1) for each 24 inches or fraction thereof in width over 42 inches

2.6 HARDWARE LOCATIONS

A. General: Locate hardware as indicated and as shown on final Shop Drawings. If location is not indicated, comply with published SDI recommendations.

2.7 FIRE RATED ASSEMBLIES

A. Provide appropriate label based on hourly fire ratings as indicated. Door frames exceeding sizes for which label service is offered shall be inspected in accordance with NFPA 80.

1. Permanently attach labels to hinge side of labeled doors and jambs (hinge side) of labeled frames.

2. Where pairs of doors are to be labeled, doors assemblies shall have passed appropriate UL test and NFPA criteria without use of astragals, except for A Labeled, 3-hour fire rated door assemblies.

B. Notwithstanding other requirements of this Specification, supply gauge of metal, method of construction, hardware preparation, glass size restriction, and other specifics required to obtain label. Label shall contain fire-resistance rating (for example, 20 minute, 30 minute, 45 minute, 1 hour, 1 1/2 hour, and 3 hour). Fire doors, when used in stairway enclosures, shall be so constructed so that maximum transmitted temperature and point shall not exceed 450 degrees F above ambient at end of 30 minutes of Standard Fire Exposure Test and shall be so noted on label.

2.8 FACTORY PRIMING

A. Finish: After fabrication, tool marks and surface imperfections shall be removed, and exposed faces of welded joints shall be dressed smooth. Frames shall be chemically treated to insure maximum paint adhesion and shall be coated on accessible surfaces with a rust-inhibitive primer which is fully cured before shipment.

2.9 CLEARANCES AND TOLERANCES

A. Comply with requirements of SDI-117.

Part 3 EXECUTION

3.1 EXAMINATION

A. Prior to installation, all frames shall be checked and corrected for size, swing, squareness, alignment, twist and plumbness in accordance with published SDI recommendations.

B. Verify that opening sizes and tolerances are acceptable.

C. Report deficiencies to Contractor prior to commencing Work.

D. Commencing Work constitutes acceptance of substrates and rough openings. Provide future work or re-work required because of deficient substrates or rough openings at no additional cost.

3.2 INSTALLATION OF HOLLOW METAL WORK

A. Install hollow metal work in compliance with SDI published recommendations, manufacturer's written instructions, and approved submittals. In the event of a discrepancy, most stringent requirement shall prevail.

B. Install fire rated doors and frames as per local code or NFPA 80, whichever is more stringent.

C. Erect frames plumb, square and aligned by use of accurate instruments. Brace frames to maintain positioning during building-in of adjacent dissimilar work.

D. Anchor each frame to adjacent construction as indicated and in accordance with approved submittals.

E. Field weld where required, grind, fill and finish to be invisible and match adjacent surfaces.

F. Keep spreaders in place until surrounding work is complete. Brace midspan of frames as required to prevent bowing. Remove spreaders and bracing when frames are firmly set. Spreaders shall not be used for installation purposes.

3.3 CLEANING AND TOUCH-UP

A. After installation, clean doors and frames of dirt, grime, grease and oil, and touch up scratched or damaged surfaces. Use type of primer used for or compatible with shop primer.

3.4 INSTALLATION TOLERANCES

A. Squareness: Plus or minus 1/16 inch measured on a line 90 degrees from one (1) jamb, at upper corner of frame at other jamb.

B. Alignment: Plus or minus 1/16 inch measured on jambs on a horizontal line parallel to plane of wall.

C. Twist: Plus or minus 1/16 inch measured at face corners of jambs on parallel lines perpendicular to plane of wall.

D. Plumbness: Plus or minus 1/16 inch measured on jamb at floor.

END OF SECTION 081113

SECTION 081416 FLUSH WOOD DOORS

Part 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Applicable Sections: Division 1.

C. Architectural Woodwork: Division 6.

D. Standard Hollow Metal Doors and Frames: Division 8.

E. Finish Hardware: Division 8.

1.2 SUMMARY (NON-INCLUSIVE)

A. Section Includes: Flush-faced, architectural-grade wood doors as follows:

1. Solid-core doors with wood-veneer, faces.
2. Factory finishing of flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for Finish Hardware.
4. Fire rated doors.

1.3 SUBMITTALS

A. Submit per the requirements of Division 1.

1. Submit together with submittals for Hydraulic Elevators: Division 14.

B. Samples:

1. For Initial Selection: Photographs of manufacturer's available logs of each specified veneer species for selection by Design Professional prior to fabrication. Veneer for doors and elevators shall be from a single source.

C. Shop Drawings:

1. Show fabrication and installation of each door. Show elevations of each door type. Show details of construction, installation, connections, anchors, reinforcement, hardware preparation and floor and threshold clearances.
2. Schedule: Show each door and opening, unique for actual location, using room number, and sub number if more than one door or opening per room. Show, as a minimum, the same information as on schedule included herein. Show hardware group on schedule.
    a. Provide one schedule for the entire project. Coordinate schedule for doors and openings of materials specified in other sections.

D. Product Data: For each type of door, including details of core and edge construction, trim for openings and louvers, and factory-finishing specifications.

E. Samples: Two (2) sets of [8 1/2 inches by 11 inches by thickness of door for the following: Samples shall show core construction on two (2) edges and stile and rail construction on two (2) sides.

1. Doors for Field Finish: Minimum of two (2) Samples demonstrating full range of color and grain variation for type of door and each species of veneer.

2. Doors with Factory Finish: Minimum of two (2) Samples demonstrating full range of color and grain variation for type of door and each species of veneer. Include stepped layers of required finish.

F. Qualifications: Manufacturer's and Installer's qualification data.

G. Certifications: Certification letters where indicated.

1. Submit certification that the doors and frames comply with NFPA 252 or UL 10C Positive Pressure Fire Door Test.

2. Certify compliance with NWWDA and AWI standards.

H. Sustainability Submittals:

1. Product data for adhesives and sealants indicating VOC content.

2. Product data for paints and coatings indicating VOC content and chemical composition.

3. Product data for products containing composite wood or agrifiber products or wood glues indicating that they do not contain urea-formaldehyde resin.

1.4 DELIVERY, HANDLING AND STORAGE

A. Store, handle, and ship doors to prevent damage, soiling or deterioration and so as not to void manufacturer's warranty. Comply with NWWDA recommendations.

B. Package each door leaf prior to shipping. Keep package intact until time of installation.

C. Mark each door with individual opening number which correlates with designation on approved submittals.

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Manufacturer shall have minimum five (5) years' experience producing products similar to those required for this Project. Manufacturer shall have documented experience of successfully providing products for three (3) projects of scope, schedule and complexity similar to this Project within last two (2) years.

1. Company marketing primary products specified for this Section shall also be manufacturer. Companies marketing products which are manufactured by third parties for private labeling by marketing company are not acceptable.

2. Submit qualifications on manufacturer's letterhead. Include project descriptions with Owner and Design Professional contacts for previous experience.

B. Installer's Qualifications: Installer shall have minimum five (5) years' experience installing products similar to those required for this Project. Installer shall have documented experience of successfully completing three (3) projects of scope, schedule and complexity similar to this Project within last two (2) years. Submit qualifications on Installer's letterhead. Include project descriptions with Owner and Design Professional contacts for previous experience.

C. Single Source Requirements: All doors required for Work of this Section shall be supplied by one (1) manufacturer. Accessory products including, for example, fasteners, sealants and anchors may be from other than primary manufacturer if approved in writing by primary manufacturer.

D. Regulatory Requirements: Comply with the following per Division 1.

1. Fire Rated Assemblies: Units shall comply with NFPA 80, shall be identical to assemblies whose fire resistance characteristics have been determined in accordance with ASTM E 152, and shall be labeled and listed by Underwriters Laboratories, Inc. (UL), Warnock Hersey, Inc. (WHI) or other Inspection and Testing Agency acceptable to code authorities having jurisdiction.

    a. Stairway Enclosure Doors: Labeled means of egress fire doors in stairway enclosures shall have a maximum transmitted temperature end point of not more than 450 degrees F above ambient at the end of 30 minutes of standard fire-test exposure.
    b. Rate of rise for indicated doors shall be a maximum transmitted temperature end point of not more than 250 degrees F above ambient at the end of 30 minutes of standard fire test exposure.
    c. Installed Door and Frame Assembly: Shall conform to NFPA 80 for fire-rated class indicated.

E. Referenced Codes and Standards: Comply with the following in accordance with Division 1.

1. National Wood Window and Door Association (NWWDA)

I.S.1 "Industry Standard for Wood Flush Doors"

"How to Store, Handle, Finish, Install and Maintain Wood Doors"

2. Architectural Woodwork Institute (AWI): "Architectural Woodwork Quality Standards", including Section 1300 "Architectural Flush Doors", Grade As Indicated

F. Certifications: Certify compliance with NWWDA and AWI standards.

1.6 FIELD CONDITIONS

A. Environmental Requirements: Do not deliver or install doors until conditions for temperature and Relative Humidity have been stabilized and will be maintained. Comply with AWI Section 100-S-3 "Moisture Content".

1.7 MAINTENANCE

A. Extra Materials: Furnish stain, putty, filler and finish required to patch damaged doors, minimum one (1) quart of each.

1.8 SPECIAL WARRANTY

A. Furnish door manufacturer's warranty providing for replacement, rehanging and refinishing, at no additional cost, of any door that becomes defective due to delamination, warpage in excess of referenced standard, telegraphing of core construction, or other defects of manufacture.

1. Interior Doors: Life of original installation.
2. Exterior Doors: Three (3) years.

Part 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Products of indicated manufacturers are acceptable, contingent upon conforming to indicated requirements. Equivalent product substitutions by other manufacturers may be acceptable, subject to requirements of Division 1.

1. Algoma Hardwoods, Inc.
2. Eggers Industries.
3. Ipik Door Company, Inc.

4. Mohawk Flush Doors, Inc.
5. Weyerhauser Commercial Door Division

2.2 MATERIALS

A. Provide recycled content materials in accordance with Sustainability Action Plan specified in Sustainability Requirements: Division 1 and as indicated below.

B. Provide regional materials in accordance with Sustainability Action Plan specified in Sustainability Requirements: Division 1.

C. Provide certified wood-based materials in accordance with Sustainability Action Plan specified in Sustainability Requirements: Division 1.

D. Do not use products or adhesives that contain urea-formaldehyde resin.

E. Use adhesives and sealants that comply with the VOC limits specified in Sustainability Requirements: Division 1.

F. Use paints and coatings that comply with the VOC limits and chemical restrictions specified in Sustainability Requirements: Division 1.

G. Particle Board: ANSI A208.1, Grade M2 exterior glue with minimum 90 percent recycled and recovered wood fiber.

H. Crossbands: Minimum 1/16-inch-thick engineered fiberboard or hardwood crossbands, free of defects and voids.

I. Edge Strips and Blocks: Laminated strand lumber with exposed face for stiles as follows: Stiles shall be tested for minimum screw withdrawal load of 700 pounds {317 kg} per ASTM D 1037.

1. Stiles for Transparent Finish Doors: Veneer or hardwood of same species, grade, color and cut as face veneer.

J. Face Veneer for Transparent Finish: Minimum 1/50-inch-thick at 12 percent moisture content, grain direction vertical, kiln and plate dried, tapeless-spliced with glue; veneers shall carry to four (4) edges of door:

1. Veneer Grade: AWI grade Premium.
2. Species: Maple quarter sawn or cut
3. Leaf Width: Minimum 4 inches and maximum 8 inches
4. Veneer Leaf Match: Book Match.
5. Veneer Face Match: Running Match.
6. Door-to-Door Match: Pair Matched.

K. For Initial Selection: Photographs of manufacturer's available logs of each specified veneer species for selection by Design Professional prior to fabrication. Veneer for doors and elevators should be from a single source. Refer to Section 064023

L. Astragals: UL listed metal edge guards and astragals where required to maintain fire-rating.

2.3 DOORS

A. Door Grade: AWI Grade Premium.

B. Construction: Fully bonded core construction, five (5) plies consisting of core, two (2) cross-bands and two (2) faces as follows:

1. Non-rated and 20 Minute Rated Doors: Particle Board Core, AWI Type PC-5 or Stave Lumber Core, AWI Type SLC-5.
2. Fire-rated Doors Over 20 Minutes: Mineral Core, AWI Type FD-5.

C. Door Edges for Transparent Finish: Conceal stiles and edges of crossbands by covering with hardwood lumber or veneer layer to match face.

2.4 FABRICATION

A. Fabricate non-rated doors per AWI Quality Standards requirements.

B. Fabricate rated doors per AWI Quality Standards requirements and as required for label or code authority.

C. Edge Strips and Blocks:

1. Minimum Edge Strip Thickness:
   a. Top and Bottom Rail: 1 1/8 inches each.
   b. Stiles: 1 3/8 inch.
   c. Mineral Core: Per label requirements.
2. Blocking: Provide minimum 5 inchwide blocking at the following locations:
   a. Top Rail: Surface mounted or recessed closers, door coordinators, face mounted bolts, surface mounted vertical rod exit devices, rabbeted transom panels.
   b. Hinge Stile: Intermediate pivot hinges, surface mounted panic hardware.
   c. Lock Stile: Surface mounted panic hardware, rabbeted astragals.
   d. Bottom Rail: Surface mounted or concealed automatic door bottoms, floor mounted door closers, surface mounted vertical rod exit devices.
   e. Exceptions: Blocking may be eliminated where hardware on both faces of door will conceal through-bolts in finished work and where core can be demonstrated to resist 700-pound withdrawal load per ASTM D 1037.

D. Door Edges:

1. Bevel: Provide standard bevel on door edges.
2. Astragals: Install astragals and edge guards only where required to maintain fire-rating of pairs of doors.

E. Prefit and pre-machine doors at factory. Prefit for size; pre-machine for beveling, mortising and drilling for finish hardware except for surface-mounted finish hardware.

1. Pre-fit to comply with indicated clearances and tolerances.
2. Pre-machine according to proper finish hardware templates.
3. Prepare doors for electrical hardware as required.

2.5 FIRE RATED ASSEMBLIES

A. Provide appropriate label based on hourly fire ratings as indicated. Doors exceeding sizes for which label service is offered shall be inspected in accordance with NFPA 80.

1. Permanently attach labels to hinge side of labeled doors.
   a. Where continuous hinges are indicated, door manufacturer shall permanently attach labels to top edge of labeled door.
2. Where pairs of doors are to be labeled, doors assemblies shall have passed appropriate UL test and NFPA criteria without use of astragals, except for A Labeled, 3 hour fire rated door assemblies.

B. Notwithstanding other indicated requirements furnish method of construction, hardware preparation, glass size restriction, and other specifics required to obtain label. Label shall contain fire-resistance rating, for example, 20 minute, 30 minute, 45 minute, 1 hour, 1 1/2 hour and 3 hour. Fire doors, when used in stairway enclosures, shall be so constructed so that maximum transmitted temperature and point shall not exceed [450 degrees F] {232 degrees C} above ambient at end of 30 minutes of Standard Fire Exposure Test and shall be so noted on label.

2.6 PREFINISHING

A. Transparent Finish: Comply with requirements indicated below for, finish system, staining, and sheen, with sheen measured on 60-degree gloss meter per ASTM D 523:

1. AWI Finish System TR-2: Catalyzed lacquer.
2. Staining: Match Design Professional's Sample.
3. Wash Coat for Stained Finish: Apply a vinyl wash coat to woodwork made from closed grain wood before staining and finishing.
4. Open Finish for Open Grain Woods: Do not apply filler to open grain woods.
5. Filled Finish for Open Grain Woods: After staining (if any), apply paste wood filler to open-grain woods and wipe off excess. Tint filler to match stained wood.
6. Apply vinyl wash coat sealer after staining and before filling.
7. Sheen: Satin, 30-50 gloss units.

Part 3 EXECUTION

3.1 EXAMINATION

A. Project Site Verification of Conditions:

1. Examine installed door frames for suitability and conformance to specified tolerances, type, size, and swing.
2. Report deficiencies to Contractor prior to commencing Work.
3. Commencing Work constitutes acceptance of frames. Provide future work or re-work required because of deficient frames at no additional cost.

3.2 INSTALLATION

A. Install non-rated doors per AWI Quality Standards requirements.

B. Install rated doors per AWI Quality Standards requirements and as required for label or code authority.

C. Site-Fit Doors:

1. Align and fit doors in frames within indicated tolerances.
2. Do not trim doors in excess of manufacturer’s limits or as permitted for fire-rated doors.
3. Bevel doors 1/8 inch in 2 inches at lock and hinge stiles.
    a. Fire-rated Doors: Limit bevel per labeling agency.
4. Machine doors for hardware.
5. Seal cut surfaces after fitting and machining.

D. Prefit and Pre-machined Doors: Fit to frame within indicated tolerances. Install surface mounted hardware.

E. Hardware: Carefully fit and attach hardware securely, using only screws and other fasteners furnished with hardware. Location of hardware is generally established on Shop Drawings. Location of items of hardware not so established will be as directed.

F. Clearances and Tolerances: Comply with AWI recommendations and as follows:

1. Jamb and Head and Gap at Pairs of Doors: 1/8 inch plus or minus 1/32 inch.
2. Thresholds and Hard Floor Finishes: 1/4 inch plus or minus 1/16 inch.
3. Carpet: 1/8 inch plus or minus 1/16 inch.
4. Fire-rated Doors: Comply with NFPA 80.

3.3 ADJUSTING

A. Operation: Rehang or replace doors which do not operate freely.

B. Factory Finish: Touch-up damage to factory finish. Replace or completely refinish doors if touch-up is visible from 3 feet under normal lighting.

C. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

3.4 PROTECTION

A. Protect doors from damage.

.

END OF SECTION 081416

SECTION 083113 ACCESS DOORS AND FRAMES

Part 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Applicable Sections: Division 1.

C. Finish Hardware: Division 8, refer to for lock cylinders.

1.2 SUMMARY (NON-INCLUSIVE)

A. Section Includes: Access doors, including wall and ceiling units as follows:

1. Access doors in various sizes and types as required, whether or not indicated, for access to each valve, waterhammer arrestor, backflow preventer, air vent, cleanout damper, fire damper, control, and other device, where access is necessary. Access doors are not required where lay-in acoustical ceilings provide adequate access.

2. Coordinate location and quantity with work of respective Sections for proper installation.

1.3 SUBMITTALS

A. Submit per the requirements of Division 1.

B. Shop Drawings: Show fabrication and installation of standard and customized access doors and frames, including details of each frame type, elevations of door design types, anchorage and accessory items.

C. Product Data:

1. Manufacturer's published technical data and installation instructions for each type of access door assembly, including setting drawings, templates, instructions, and directions for installation of anchorage devices.

2. Access Door Schedule: Include types, general locations, sizes, wall and ceiling construction details, finishes, latching or locking provisions, and other data pertinent to installation.

D. Samples: Minimum two (2) 3 inches by 5 inches minimum size, of each panel face material showing factory-finished color and texture.

E. Sustainability Submittals: Provide the following in accordance with Sustainability Requirements: Division 1.

1. Materials Sustainability Documentation Form.

2. Product data, certification letter, and costs for materials with recycled content.

3. Product data and costs for regional materials.

F. Closeout Submittals: Special Warranty, as indicated.

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1.4 QUALITY ASSURANCE

A. Single-Source Responsibility: Obtain access doors for entire Project from one (1) source from a single manufacturer.

B. Fire Resistance Ratings: Wherever a fire resistance classification is indicated, provide access door assembly with panel door, frame, hinge, and latch from manufacturer listed in Underwriters Laboratories, Inc.'s "Building Materials Directory" for rating indicated. Provide UL label on each fire-rated access door.

C. Size Variations: Obtain Design Professional's acceptance of manufacturer's standard size units, which may vary slightly from sizes indicated.

1. Coordination: Coordinate specific locations and sizes for required access doors with work of other sections requiring access to concealed equipment. Furnish inserts and anchoring devices that must be built into other Work for installation of access doors.

1.5 SPECIAL WARRANTY

A. Installation shall be Warranted for five (5) years from Date of Substantial Completion against defects in materials and workmanship. Submit certificate of Special Warranty.

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Part 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Products of indicated manufacturers are acceptable, contingent upon meeting indicated requirements. Equivalent products of other manufacturers will be evaluated as substitutions in accordance with requirements of Division 1.

1. The Williams Brothers Corporation.
2. Milcor, Inc.
3. Karp Associates, Inc.
4. Nystrom.
5. Babcock-Davis.
6. Acudor Products Inc.
7. The Bilco Company (floor units only).
8. Dur-Red Products (floor units only).

2.2 WALL AND CEILING UNITS

A. Integral access door unit shall consist of concealed hinged door, perimeter frame, anchors and cam locks. Hinges shall be spring type with loose pins permitting removal of door. Locks shall be screwdriver slot operated. Anchors shall be of type applicable to suit adjoining construction.

B. Provide labeled rated access doors matching rating of surface in which access door is located.

C. Finishes:

1. Prime coat units, unless otherwise indicated, with chemically bonded primer coat of baked enamel.
2. Stainless steel units shall have No. 4 satin finish. Frame and Door.

D. Frames: Fabricate from 16-gauge primed steel, except stainless steel with No. 4 satin finish at ceramic tile with exposed flange nominal 1 inch wide around perimeter of frame.

1. For gypsum wallboard or gypsum veneer plaster, provide perforated frames with gypsum wallboard bead.

E. Flush Panel Doors: Fabricate from not less than 14 gage primed sheet steel, except stainless steel at ceramic tile, with concealed spring hinges or concealed continuous piano hinge set to open 175 degrees. Finish with manufacturer's factory-applied prime paint.

1. For fire-rated units, provide manufacturer's standard insulated flush panel/doors, with continuous piano hinge and self-closing mechanism.

F. Recessed Panel Doors: Fabricate from not less than 18 gage steel with face of panel formed to provide recess below surface of applied finish. Reinforce panel as required to prevent buckling. Finish with manufacturer's factory-applied prime paint.

1. Furnish recessed panels for concealed installation in acoustic tile ceiling systems.

2. Furnish recessed panels and frames with expanded metal lath for concealed installation in plaster.

G. Locking Devices: Furnish flush, screwdriver head cam locks of quantity required to hold door in flush, smooth plane when closed.

1. Provide one (1) cylinder lock per access door. Provide two (2) keys per lock. Key all locks alike, unless otherwise indicated.

2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

2.3 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

2. Factory Finished: Apply manufacturer's standard baked-enamel or powder-coat finish immediately after cleaning and pretreating, with minimum dry-film thickness of 1 mil (0.025 mm) for topcoat.

a) Color: Match: As selected by Architect from full range of industry colors

Part 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instruction for installation of access doors.

B. Coordinate installation with Work of other Sections.

C. Set frames accurately in position and securely attach to supports with face panels plumb or level in relation to adjacent finish surfaces.

3.3 ADJUST AND CLEAN

A. Adjust hardware and panels after installation for proper operation.

B. Remove and replace panels or frames that are warped, bowed, or otherwise damaged.

END OF SECTION 083113

SECTION 08 35 13.23 ACCORDION FOLDING FIRE DOORS

PART 1 – GENERAL

1.01 SUMMARY OF WORK

A. Division 0 and 1, as indexed, apply to this section.

B. Furnish and install all horizontal sliding, accordion folding fire doors shown on the drawings and specified herein.

1.02 RELATED SECTIONS

A. All headers, support structures, fire protection of support structures, surrounding insulation, jambs, storage pockets, blocking and trim shall be furnished and installed by other sections.

B. All electrical wire, wiring, conduit and electrical boxes shall be furnished and installed by electrical section including connections to smoke detectors and building fire alarm panels.

C. Drilling/placement of anchorage points into pre or post tensioned decks, welding/punching/drilling steel members and all drywall work.

D. All track, soffit, chain guide and wall mounted striker pieces and integrated pocket cover door surface shall be painted by Section 09900. Color shall be selected by the architect.

1.03 QUALITY ASSURANCE

A. Installation shall be performed by factory trained and certified installers with a minimum of three years' experience installing electrically operated accordion folding fire doors.

B. Fire doors shall be listed by Underwriters Laboratories for ratings as indicated, when tested in accordance with the requirements of UL 10B NFPA 252.

C. Automatic closing system shall be listed by Underwriters Laboratories in accordance with the requirements of UL 864 and be listed for use with the assembly in compliance with NFPA 80, Chapter 9.

D. Fire doors used for smoke and draft control shall bear the "S" mark on the fire door label and shall have an air leakage of less than 3 ft^3/ft^2 at 0.1 inch of water column pressure when tested in accordance with UL 1784 with an artificial bottom seal.

E. Fire Doors shall be capable of resisting an air pressure differential up to 0.05 inches of water column.

1.04 SUBMITTALS

A. See Section 01 30 00 – Submittal Procedures, for submittal procedures.

B. Product Data: Provide manufacturer's technical literature, include UL listing data.

C. Shop Drawings: Indicate construction and installation details and dimensions, including layout, electrical requirements, required stack depth, height of header above finished floor, and requirements for anchorage and support of each door.

D. Operation and Maintenance Data: Operating procedures, troubleshooting and repair methods, and wiring diagrams.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver to the job site in manufacturer's original, unopened package.

1.06 COORDINATION BY GENERAL CONTRACTOR

A. Coordinate with the following:
   1. Fire Alarm system.
   2. Electrical.
   3. Pocket cover doors (if required).
   4. Floor and ceiling finish.

B. Assure accurate installation of header, jamb, and trim. Provide "As-Built" dimensions for opening and storage pocket. Supervise unloading and handling of materials.

C. Store boxes flat (not more than three high) in a protected dry area. Replace damaged materials at no cost to owner.

D. Permanent power shall be in-place and ready for final connection when fire doors are installed. Assure access to and proper clearance for motor operators.

E. After testing the fire alarm system, automatic-closing fire doors shall be re-set to the original position.

1.07 WARRANTY

A. Materials and installation shall be warranted against defects in workmanship for a period of one (1) year from the date of substantial completion.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Horizontal sliding accordion folding fire doors shall be Won-Door FireGuard FG-90 custom cover door by others, as manufactured by Won-Door Corporation, Salt Lake City, UT.

B. Products of other manufacturers demonstrating complete compliance with each of the fire rating and performance criteria of the product specified will be considered for approval. Written requests for substitutions will be considered by the architect up to ten days prior to the bid date.

2.02 ACCORDION FIRE DOORS – GENERAL

A. Provide electrically powered self-closing fire doors of configurations indicated on the drawings.
   1. Fire rating as required.

B. Fire Rating – Fire doors shall be listed by Underwriters Laboratory as special purpose fire doors having a fire protection rating as indicated by the selected model, and in accordance with the requirements of UL 10B and NFPA 252.

C. Closing and Opening Operation: Automatic Closing System including motor operator and releasing devices shall be a Microprocessor-based system rated to UL864 (Releasing Device Control Unit) and shall commence closing upon activation by fire alarm system and/or by low battery charge.
   1. Obstruction Detection: Contact with an obstruction shall cause the door to stop, reverse enough to remove pressure on the leading edge, pause, and then re-close when in an alarm condition.

2. While the door is opening under motor power, constant pressure to the leading edge in the direction of opening shall cause the door to continue to open until the leading edge is released. This is termed motor-assisted opening.
3. Constant pressure to the leading edge while not under motor power shall prevent motor operation and allow the door to be opened manually.
4. The door will operate with 30 pounds of force or less to set the door in motion.
5. The door will operate with 15 pounds or less to close the door or open it to the egress width.
6. The door will be openable with 15 pounds or less when a force of 250 pounds is acting perpendicular to the door path.

D. Exit Hardware Operation: Provide fire exit hardware on both sides of door.

1. In emergency mode, a slight pressure on the hardware will cause the door to open a minimum of 32 inches or required egress width within 10 seconds, pause for 3 seconds, and then automatically close.
2. The open distance shall be field programmable, up to the entire opening width.
3. The pause before re-close shall be field programmable up to 30 seconds.
4. The exit hardware shall have the ability when not in the emergency (fire) mode to be used to open the door and move it back into the storage pocket.

2.03 COMPONENTS

A. Door Construction: Two parallel, accordion-type walls independently suspended with no floor tracks, pantographs, or interconnections.
   1. Panels: 24 gauge steel, V-grooved; modular in design; capable of in-place repair.
   2. Perimeter Seals**:** shall consist of continuous extruded vinyl sweeps attached to the top and bottom of the fire door to form a smoke and draft seal.
   3. Hanging Weight: 5.5 pounds per sq. ft. when extended across opening.
   4. Finish: All steel parts factory-applied enamel.
   5. Color: Manufacturer's standard platinum.

B. Suspension System: Two tracks, on 8 inch centers, attached to overhead structural support.
   1. Tracks: .125 aluminum or 14 gauge cold rolled steel.
   2. Panel Hangers: Every other panel is suspended by a steel hanger pin and ball bearing roller.
   3. Lead Post Hangers: type as indicated in drawings.

C. Power Supply: 120 volt power source to power supply for main power. On loss of AC power, the 12v/24v battery back-up system shall provide full operation capability.

D. Automatic Closing System shall be listed to UL864 including capability to send and receive signals from the Fire Control Panel, and shall consist of the following:
   1. Microprocessor based Electronic Control box with the ability to:
      a. Monitor dual power sources continually for peak performance including:
         1) Detect a missing battery, bad battery, or low battery condition.
         2) Detect if the charging circuit is bad.
         3) Detect fuse failures.
         4) Detect high or low AC conditions.

b. Monitor the health of the drive train.

c. Monitor inputs including: sticky door block, exit hardware, patron hardware, and key switches.

d. Run a "watch dog" monitoring circuit which will force a software restart in the event the software hangs, including tracking the number of resets that occur for diagnostic purposes.

e. Withstand voltages up to 120 volts AC on the fire alarm input circuit without damage including the ability to indicate that the alarm circuit has not been wired as a dry contact, "no voltage" circuit when errant voltages are applied to the circuit.

f. Communicate with other microprocessors on the system via an internal buss system.

g. Indicate faults or supervised information both locally and at a remote location.

2. Motor Operator Assembly including a DC gear-motor, drive sprocket, clutch, and position sensors. The motor shall drive the fire door by means of a chain attached to a stabilizer bar trolley. The motor shall be rated for continuous use with unlimited cycle duty.

3. Leading Edge Obstruction Detector shall be pressure sensitive such that contact with an obstruction shall cause the door to stop, pause for 3 seconds, then re-close when in alarm mode. The obstruction detection system shall be fully functional at all times.

4. Exit Hardware will be located on both sides of each fire door.

E. The header shall be provided as an integrated part of the door assembly. It shall Include integrated self-supporting track, threaded rods and mechanical attachment hardware.

F. A Key Switch shall be provided, located as directed by the Architect.

G. Access Control: Shall inactivate Fire Exit Hardware and sound an audible alarm in an attempt is made to manually operate the door assembly. A key switch shall be provided for authorized operation of the door assembly. A signal from the smoke detector or fire alarm will automatically override the access control feature.

H. An LED backlit exit device that activates and flashes when the door is in egress mode.

2.04 RELATED CONSTRUCTION

A. Track Support Construction: Provide supports attached to structure and mounting surface for track including drilling/placement of anchorage points into pre or post tensioned decks, welding/punching/drilling steel members, and all drywall work; comply with door manufacturer's instructions and recommendations.

B. Pocket Construction: Provide pocket for concealment of accordion door when open; comply with door manufacturer's instructions and recommendations.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify that adjacent construction is suitable for installation of door.

B. Verify that electrical utilities have been installed and are accessible.

C. Verify that door opening is plumb and header is level and of correct dimensions.

D. Notify Architect of any unacceptable conditions or varying dimensions.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions, shop drawings and NFPA 80.

B. Install fire doors plumb and level.

3.03 ADJUSTING

A. Adjust door installation to provide uniform clearances and smooth, quiet, non-binding operation.

B. Test that all operations are functional and meet the requirements of local codes.

3.04 CLEANING

A. Clean surfaces using manufacturer's recommended means and methods.

3.05 PROTECTION

A. Protect installed work from damage.

3.06 STORAGE OF WASTE AND RECYCLING

A. Store and recycle waste in accordance with Section 01 74 19 Construction Waste Management and Disposal.

END OF SECTION

SECTION 084213 ALUMINUM ENTRANCES

Part 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Applicable Sections: Division 1.

C. Fluoropolymer Coatings: Division 5.

D. Exterior Enclosure, General: Division 7.

E. Air/Vapor Barriers: Division 7.

F. Joint Sealants: Division 7.

G. Glazing: Division 8.

H. Finish Hardware: Division 8.

1.2 SUMMARY (NON-INCLUSIVE)

A. Section Includes:

1. Aluminum entrance doors.
2. Vestibule doors match entrance doors.
3. Interior entrance doors.
4. Interior glass doors and partitions.

1.3 SUBMITTALS

A. Submit per the requirements of Division 1.

1. Submittals will not be reviewed without receipt of Preliminary Certification letters indicated in Section 014700.

B. Shop Drawings: Show materials, gauges, finishes, anchorage, flashing, hardware preparation, trim and closures. Show how system complies with specified criteria including, but not limited to, accommodation of structural movement, thermal cycling and control of water penetration, air infiltration and vapor migration.

1. Elevations: Minimum [1/4-inch equals 1 foot] {1:50} scale elevations of each storefront frame and door.
2. Details: Minimum 3-inch equals 1-foot scale details of each assembly including heads, sills, mullions, corners, relationships with abutting construction attachments to adjacent construction and joints in system.
3. Show sufficient information to trace continuity of inner and outer line of seals, (rain screen and air barrier) and to trace continuity of air/vapor barrier if location differs from inner seal.

4. Schedule: Show each door and opening, unique for actual location, showing room number, and sub number if more than one door or opening per room. Show, as a minimum, the same information as on schedule included herein. Show hardware group on schedule.

   a. Where doors or opening are indicated by generic type instead of unique mark for actual location, list all doors and openings by unique mark under each heading for the generic type indicated.
   b. Provide one schedule for the entire project, coordinate schedule for doors and openings of materials specified in other sections.

C. Product Data: On framing system, doors, door hardware and accessories. Include structural capacity information showing product complies with indicated criteria. Submit test reports showing compliance with air and water infiltration criteria.

1. Condensation Resistance: Submit adequate data to establish compliance with specified criteria.

D. Samples:

1. Finish Samples: Per requirements of Fluoropolymer Finish: Division 5.

2. Sample Assembly: One (1) full size Sample for each assembly listed. Include all components required in assembly.

E. Calculations: Performed by, or under direct personal supervision of, Manufacturer's Design Engineer. Shop Drawings will not be reviewed without associated calculations. Calculations shall demonstrate compliance with design criteria indicated. Submit the following calculations:

1. Member section properties, stresses, deflections and rotations.

2. Member to member connection detail forces and stresses.

3. Building anchorage detail forces and stresses.

4. Thermal movements.

F. Qualifications: Manufacturers, Designers and Installers qualifications.

G. Sustainability Submittals: Provide the following in accordance with Sustainability Requirements: Division 1.

1. Materials Sustainability Documentation Form.

2. Product data, certification letter, and costs for materials with recycled content.

3. Product data and costs for regional materials.

4. Product data for adhesives and sealants indicating VOC content.

5. Product data for paints and coatings indicating VOC content and chemical composition.

H. Closeout Submittals:

1. Maintenance Data: For operable hardware.

1.4 SYSTEM DESCRIPTION

A. Design: Engineer system to perform in compliance with indicated criteria and to comply with indicated design intent.

1. Maintain basic dimensions of system, sight lines, jointing, and profiles. Minor variation is allowable only with approval of Design Professional and if variations are identified on submittals.

2. Engineer components of system not fully detailed within a reasonable inference of design intent.

B. Structural Requirements: Withstand loading and deflection criteria in accordance with Exterior Enclosure, General: Division 7.

C. Movement: Accommodate movement criteria in accordance with Exterior Enclosure, General: Division 7.

D. Air and Water Requirements: Comply with criteria per Exterior Enclosure, General: Division 7 and the following.

1. Limit air infiltration at doors to 1.0 cfm per lineal foot of crack at a pressure differential of 10 psf as measured in accordance with ASTM E 283.

E. Condensation Resistance: System; including but not limited to, shadow boxes, sub-sills, brake metal, trim, panels, door frames or sub-frames, filler strips and spandrel panels, shall not allow condensation on interior surfaces under the following conditions.

1. Exterior Winter Temperature: 10 degrees F.

2. Interior Winter Temperature: 72 degrees F.

3. Interior Relative Humidity: 30%.

F. Condensation Resistance Factor (CRF) of frame and glass shall be minimum of 55 when tested in accordance with AAMA 1503. Certify that all non-typical conditions including, but not limited to, shadow boxes, sub-sills, recessed areas, door frames or sub-frames, filler strips and spandrel panels are designed in a manner that provides thermal performance comparable to tested CRF value indicated above.

1.5 DEFINITIONS

A. Exposed Surfaces: Surfaces visible in the finished Work when viewed from any sightline between 3 feet to 7 feet 6 inches above finished floor, when doors and drawers are closed; bottoms of casework more than 4 feet above finished floor, backs of hinged doors, and edges of hinged doors exposed when opened.

1.6 QUALITY ASSURANCE

A. Manufacturer's Qualification: Manufacturer shall have minimum five (5) years' experience producing products similar to those required for this Project. Manufacturer shall have documented experience of successfully providing products for three (3) projects of scope, schedule and complexity similar to this Project within last two (2) years.

1. Company marketing primary products specified for this Section shall also be manufacturer. Companies marketing products which are manufactured by third parties for private labeling by marketing company will not be allowed.

2. Manufacturer's Design Engineer: Professional Engineer, licensed in Commonwealth of Kentucky and having a minimum of five (5) years' experience designing systems similar to those required for this Project. Design Engineer shall sign and seal calculations.

B. Installer's Qualifications: Installer shall have minimum five (5) years' experience installing products similar to those required for this Project. Installer shall have documented experience of successfully completing three (3) projects of scope, schedule and complexity similar to this Project within last two (2) years.

1. Welding shall be performed by certified welders, qualified or licensed in accordance with local building regulations and shall conform to recommended practices of American Welding Society.

2. Submit qualifications on Installer's letterhead. Include project descriptions with Owner and Design Professional contacts for previous experience.

C. Single Source Requirements: All primary products required for Work of this Section shall be supplied by one (1) manufacturer. Accessory products including, for example, fasteners, sealants and anchors may be from other than primary manufacturer if approved in writing by primary manufacturer.

D. Regulatory Requirements:

1. Comply with ANSI A 117.1 and ADA Accessibility Guidelines.

E. Certifications: Comply with Exterior Enclosure, General: Division 7.

F. Mock-ups: Provide entrances and storefronts required for mock-up in accordance with Exterior Enclosure, General: Division 7.
G. Preinstallation Meeting: Refer to Exterior Enclosure, General: Division 7.
H. Inspection and Testing: Services of and independent Inspection and Testing Agency are required in conjunction with Work of this Section: Refer to Division 1.

1.7 DELIVERY, HANDLING AND STORAGE

A. Protect prefinished surfaces with wrapping or strippable coating. Do not use adhesives which bond or leave a residue.

1.8 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F during and 48 hours after installation.
B. Verify that field measurements are as indicated on Shop Drawings.

1.9 SEQUENCING

A. Do not cover Work which is to be inspected or tested until directed.

1.10 WARRANTY

A. Provide three (3) year Warranty under provisions of Division 1 and Contract.
B. Installer agrees to repair or replace components of aluminum-framed storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
C. Warranty: Include coverage for complete system for failure to meet specified requirements.
D. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

Part 2 PRODUCTS

2.1 MANUFACTURERS

A. Products of indicated manufacturers are acceptable, contingent upon meeting all indicated requirements. Equivalent products of other manufacturers will be evaluated as substitutions in accordance with requirements of Division 1.

1. Wausau
2. EFCO Corporation.
3. Amarlite Architectural Products.
4. Tubelite Division of Indal, Inc.

2.2 MATERIALS

A. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.

2. Failure also includes the following:

   a. Thermal stresses transferring to building structure.
   b. Glass breakage.
   c. Noise or vibration created by wind and thermal and structural movements.
   d. Loosening or weakening of fasteners, attachments, and other components.
   e. Failure of operating units.

B. Aluminum alloy and temper to suit intended purpose.

1. Extruded Shapes and Tubes: ASTM B 221.

2. Sheet and Plate: ASTM B 209.

3. Structural Shapes: ASTM B 308.

4. Drawn Seamless Tube: ASTM B 210.

5. Castings: ASTM B 26, B 108, B 85.

6. Welding Rod: AWS A 5.10.

C. Galvanized Steel Sheet: ASTM A [653] {653M}, grade to suit intended purpose, galvanized per ASTM A653/A653M to coating designation G60.

D. Steel Sections: ASTM A 36, galvanized after fabrication per ASTM A 123.

E. Structural Steel Tubing: ASTM A 500, Grade B, galvanized after fabrication per ASTM A 123.

F. Anchorage Clips and Fabrications: High-strength aluminum or nonmagnetic stainless steel or steel hot dip galvanized after fabrication per ASTM A 123.

G. Concrete Inserts: Cast-iron, malleable iron or steel hot dip galvanized after fabrication per ASTM A 123.

H. Continuous Adjustable Concrete Inserts: Stainless steel channels with welded anchor legs with special "tee" head bolts. Cap ends of channel or fill with foam to keep out wet concrete. Manufactured by Unistrut or Halfen.

I. Insulation: As specified in Building Insulation: Division 7.

J. Fasteners:

1. Contacting aluminum and dissimilar metals: Stainless steel, ASTM F 593 and F 594 Alloy Group 1, finish to match adjacent surface if exposed.

2. Contacting steel or galvanized steel only: Hot dip galvanized steel conforming with ASTM B 633, SC4 or ASTM A 153.

K. Coatings:

1. Shop primer for steel: SSPC-Paint 20.

2. Touch-up Primer for Galvanized Steel: Primer with minimum 80 percent zinc in dry film complying with SSPC 20.

3. Dissimilar Metal Coating: Cold-applied asphalt mastic or other non-conductive, non-absorptive material.

L. Foam Tape: Nine (9) pcf density, self-adhesive, foam tape with flame retardants to meet FMVSS 302 flammability standard. Norton V 780 or approved substitution. Provide tape 1 inch wide, unless otherwise indicated, by the following thickness.

1. Provide 1/8-inch-thick at metal panels, concrete or other smooth substrate.

2. Provide 1/4-inch-thick at masonry or similar rough substrate.

M. Butyl Coated Foam Tape: Soft, compressible PVC foam core encapsulated with 100 percent solids butyl. "Norex" by Norton or approved substitution. Provide [1/8 inch by 1/2 inch] {3 mm by 13 mm} tape, unless otherwise indicated.

2.3 DOORS

A. Standard duty extruded aluminum tubular frames with minimum wall thickness of 0.125 inch and depth of 1 3/4 inch.
B. Thermal extruded aluminum frame with minimum wall thickness of 0.125 inch and depth of 2 inches. Exterior aluminum shall be separated from interior aluminum with a rigid, structural thermal barrier.
C. Profiles:

1. Narrow:

a. Stiles: 2 1/8 inch
b. Head: 2 3/8 inch
c. Bottom Rail: 4 inches. 12 inches minimum for ADA requirements.

D. Stops shall be square.
E. Doors to be sliding where indicated on drawings.

2.4 GLASS AND GLAZING

A. In accordance with Glazing: Division 8.

2.5 FLASHING AND BRAKE METAL

A. Flashing concealed with system shall be aluminum.
B. Concealed flashing where system abuts dissimilar materials shall be minimum 20 gage stainless steel.
C. Exposed flashing shall be aluminum, finished to match system, minimum 0.062 inch.
D. Brake metal and other similar formed sheet fillers and trim shall be minimum 0.125-inch aluminum, finished to match system. At joints in brake metal, fold back edges or weld on concealed 1/8-inch aluminum angles to provide minimum 1 1/2-inch-deep support for sealants backer.

2.6 SEALANTS

A. Sealants within system shall be ASTM C 920 silicone or epoxy as recommended in writing by manufacturer.
B. Sealants for use in field shall be in accordance with Joint Sealants: Division 7.

2.7 HARDWARE

A. Finish Hardware to be provided by Finish Hardware: Division 8 for installation by this Section.
B. Automatic door operators in accordance with Division 8. Coordinate requirements for operators with Work of this Section.
C. Cylinders are supplied under Finish Hardware: Division 8.
D. Thresholds: Extruded aluminum, one (1) piece per opening, ADAAG compliant, ribbed, non-slip.
E. Weatherstripping:

1. Jambs and heads to have continuous nylon pile weatherstripping at stops. Bottom of floor shall have a concealed mounted nylon pile weather-strip in bottom channel.

2. Double acting doors shall have nylon pile weatherstripping mounted to doors on all four (4) sides. Door head and sill weatherstripping shall be concealed mounted in door channels. Stiles shall have an integral groove in frame member to accept weatherstripping.

2.8 FABRICATION

A. Fabricate entrance and storefront components to designs, sizes and thicknesses indicated and as required to comply with specified performance requirements. Match approved Samples. Comply with approved submittals.
B. Prefabrication: Complete fabrication, assembly, finishing, hardware application and preparation and other Work to greatest extent possible before shipment to Project Site. Disassemble components only as required for shipment and installation. Shipping of stock lengths of frame member components for cutting to length on Project Site is not acceptable.
C. Perform fabrication operations, including cutting, fitting, forming, drilling and grinding of metal work to prevent damage to exposed finish surfaces.
D. Welding: Comply with AWS recommendations. Exposed welds are not acceptable. Welding behind finished surfaces shall be performed to avoid distortion or discoloration of finish.
E. Reinforcing: Install reinforcing as required for hardware and performance requirements.
F. Weathertightness: Fabricate so that sealant is not foremost or only means to furnish a watertight assembly and to direct water out of system through weep holes.
G. Dissimilar Metals: Separate dissimilar metals with SSPC 20 paint, sealant or gasket.
H. Continuity: Maintain accurate relation of planes and angles with hairline fit of contacting members.
I. Uniformity: Abutting members shall not have an integral texture or color variation greater than half the range indicated in approved Samples.
J. Anchorage: Prepare members for attachment to adjacent structure and each other. Fabricate, for example, anchors, clips and cleats.
K. Fasteners: Fasteners shall be concealed from eye level view in Finished Work.
L. Receivers and Sub-sills: Fabricate to required dimensions. Weld on end dams at all sub-sills. Fabricate joints to allow for movement without affecting water-tightness.
M. Flashing: Fabricate in accordance with Flashing and Sheet Metal: Division 7.
N. Doors: Fabricate with mechanical joints using heavy inserted reinforcing plate and concealed tie rods or J-bolts. Fabricate to facilitate replacement of glass without disassembly of door frame using removable interior stops and concealed fastened exterior stops.

2.9 FINISHES

A. General:
    1. Shop finish Work including priming of surfaces not to be exposed to view in Final Work.
    2. Finish aluminum entrance and storefront to match interior and exterior adjacent components of the exterior enclosure, unless indicated otherwise.
B. High Performance Organic Coating: In accordance with Fluoropolymer Coatings: Division 5.

2.10 SOURCE QUALITY CONTROL

A. Comply with applicable tolerances listed under written installation instructions of this Section for shop fabrication.
B. Comply with Exterior Enclosure, General: Division 7.

Part 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and supports, with Installer present, for compliance with requirements indicated, installation tolerances, and other conditions that affect installation of aluminum entrances and storefronts.
B. Do not proceed with installation until unsatisfactory conditions are corrected.
C. Proceeding with installation constitutes acceptance of substrates and supports.

3.2 PREPARATION

A. Isolation: Separate substrates and supports which could cause corrosion or electrolytic action with aluminum storefront by painting, gaskets or similar method.

B. Prepare surfaces that are in contact with structural sealant according to sealant manufacturer's written instructions, to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

3.3 INSTALLATION

A. General: Comply with manufacturer's written instructions and recommendations for installation. Comply with approved submittals and Mock-up.

1. Installation of coating system components shall comply with requirements of all applicable local, state and national code jurisdictions.

B. Sub-Sill: Set sub-sill flashing in a triple row of sealant. Anchor sub-sill using clips or anchors without penetrating horizontal portion of sub-sill. Seal watertight. Provide foam tape between sub-sill and frame.

C. Receivers: Set receiver channels with concealed anchors to adjacent construction. Seal all penetrations and anchorage points.

D. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

E. Provide alignment attachments and shims to permanently fasten system to building structure.

F. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances.

G. Provide thermal isolation where components penetrate or disrupt building insulation.

H. Separate aluminum and other corrodible metal surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

1. Zinc or cadmium plate steel anchors and other unexposed fasteners after fabrication.

2. Paint dissimilar metals where drainage from them passes over aluminum.

3. Paint aluminum surfaces in contact with mortar, concrete or other masonry with alkali resistant coating.

4. Paint wood and similar absorptive material in contact with aluminum and exposed to elements or otherwise subject to wetting, with two (2) coats of aluminum house paint. Seal joints between materials with sealant.

I. Drill and tap frames and doors and apply surface-mounted hardware items. Comply with hardware manufacturer's written instructions and template requirements. Use concealed fasteners wherever possible. Set thresholds in a bed of mastic and secure.

J. Glazing: Refer to Glazing: Division 8.

K. Sealants: Refer to Joint Sealants: Division 7.

3.4 ERECTION TOLERANCES

A. Limit variations from plumb, level or dimensioned angle to the following:

1. 1/8-inch maximum deviation in any story height, or in any 10 feet vertical or angular run, or in any 20-foot horizontal run, non-cumulative.

2. 1/4-inch maximum deviation in any 40-foot run, any direction, non-cumulative.

B. Limit variations from ideal location (theoretical calculated positions in plan or elevation based on established floor lines and column lines), including variations from plumb and level, to the following:

1. 1/4-inch total maximum deviation for any element at any location, non-cumulative.

2. 1/4-inch maximum change in deviation for any element for any 10-foot run, any direction, non-cumulative.

C. Limit offset in end-to-end or edge-to-edge alignments of adjoining consecutive elements indicated to be flush, continuous or planar to the following:

1. Interior: 1/32 inch.

2. Exterior: 1/16 inch.

D. Limit variation from indicated position in end-to-end or edge-to-edge alignments of adjoining consecutive elements indicated to be less than [1/2 inch] {13 mm} out-of-plane or are separated by a maximum [2 1/2 inch] {65 mm} wide member to the following:

1. Interior: 1/16 inch.

2. Exterior: 1/8 inch.

E. Limit variation from indicated position in end-to-end or edge-to-edge alignments of adjoining consecutive elements indicated to be 1/2 inch or more out-of-plane or are separated by a member wider than 2 1/2 inches to the following:

1. Interior: 1/8 inch.

2. Exterior: 3/16 inch.

F. Limit maximum width of a hairline joint as follows:

1. Interior: 0.020 inch.

2. Exterior: 0.050 inch.

G. Limit maximum variation is width of a hairline joint as follows:

1. Interior: 0.005 inch.

2. Exterior: 0.020 inch

H. Limit difference in diagonal measurements to 1/8 inch.

I. Comply with stricter tolerances if required for glazing or to meet specified performance criteria.

3.5 FIELD QUALITY CONTROL

A. Comply with Exterior Enclosure, General: Division 7.

3.6 ADJUSTING

A. Adjust operating hardware to function properly, for smooth operation without binding, and for weathertight closure.

3.7 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Remove dirt from corners. Wipe surfaces clean.

C. Remove excess sealant by method approved in writing by sealant manufacturer.

3.8 PROTECTION

A. Institute protective measures required throughout remainder of Construction Period to ensure that aluminum entrances and storefronts will be without damage or deterioration, other than normal weathering, at Date of Substantial Completion.

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END OF SECTION 084313

SECTION 084413 ALUMINUM CURTAINWALL

Part 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Applicable Sections: Division 1.

C. Inspection and Testing of Exterior Enclosure: Division 1.

D. Fluoropolymer Coatings: Division 5.

E. Exterior Enclosure, General: Division 7.

F. Building Insulation: Division 7.

G. Firestopping: Division 7.

H. Flashing and Sheet Metal: Division 7.

I. Joint Sealants: Division 7.

J. Aluminum Entrances and Storefronts: Division 8, refer to for door assemblies.

K. Glazing: Division 8.

1.2 SUMMARY (NON-INCLUSIVE)

A. Section Includes: A glazed aluminum curtainwall system as follows:

1. Curtainwall framing system.
2. Metal spandrel panels and other non- panels.
3. Column covers, soffits, sills, coping, trim and similar border and filler items.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project Site

1.4 SUBMITTALS

A. Submit per the requirements of Division 1.

1. Submittals will not be reviewed without receipt of Preliminary Certification letters indicated in Inspection and Testing of Exterior Enclosure: Division 1.
2. Submittals will not be reviewed until satisfactory completion of mock-up and laboratory testing. Submittals forwarded prior to completion of testing will be returned "Revise and Resubmit" or placed on hold until completion of testing. Allowable time period for review of submittals will not begin until after completion of testing.

B. Shop Drawings: Show fabrication and installation details, materials, dimensions, gauges, trim, fasteners, closures and finishing including all attachments and joint sealants to surrounding construction. Show how system complies with specified criteria including, but not limited to accommodation of structural movement, thermal cycling and control of water penetration, air infiltration and vapor migration.

1. Elevations: Minimum 1/4-inch equals 1 foot {1:50} scale elevation of each area of curtainwall.

2. Details: Full size details of each assembly including heads, sills, mullions, corners, intersection with abutting construction and joints in system.

a. Assembly Details: Multiple, exploded, isometric, three-dimensional details showing the sequential assembly of typical intersections including but not limited to corners, tee intersections and cross intersections. Show each sealant, gasket and accessory required for the system to function in compliance with indicated requirements.

3. Show sufficient information to trace continuity of inner and outer line of seals, (rain screen and air barrier) and to trace continuity of air/vapor barrier if location differs from inner seal.

4. Shop Drawings shall be prepared directly by the manufacturer with manufacturer's logo and bearing the name and contact information and signature of manufacturer's design engineer.

a. Shop Drawings may be prepared by licensed or otherwise approved installers or fabricators, and shall be accompanied by a certification letter on manufacturers letterhead, signed by manufacturers design engineer, stating that the manufacturers engineering department has reviewed the shop drawings and Contract Documents and verifies that systems represented in the shop drawings are compliant with manufacturers recommendations, contain sufficient detail to direct construction in compliance with manufacturers recommendations, are suitable for intended application and that the shop drawings are of a level of quality and completeness as if the manufacturer prepared the shop drawings themselves.

C. Product Data: Manufacturer's published specifications for joint sealants, materials and fabrication and installation instructions. Furnish test reports indicating compliance with specified criteria.

1. Structural Silicone Glazing Reports: Comply with Glazing: Division 8.

D. Samples:

1. Finish Samples: Three-hole punch Samples for binder per requirements of Fluoropolymer Coatings: Division 5.

2. Sample Assembly: Two (2) full size Samples for each assembly listed. Include all components required in assembly.

a. Intersection Sample: Vertical and horizontal mullion minimum 2 feet square.

E. Calculations: Performed by, or under direct personal supervision of, Manufacturer's Design Engineer. Shop Drawings will not be reviewed without calculations. Calculations shall demonstrate compliance with design criteria indicated. Submit the following calculations:

1. Member section properties, stresses, deflections and rotations.

2. Member to member connection detail forces and stresses.

3. Building anchorage detail forces and stresses.

4. Thermal movements.

F. Qualifications: Proof of compliance with indicated qualifications. -

G. Quality Control Procedures:

1. Independent Test Reports: Reports from independent laboratories, AAMA certified or otherwise qualified to perform the required test as acceptable to Design Professional, documenting compliance with indicated criteria.

a. Submit a certification letter from the manufacturer stating that the tested mock-up is essentially identical to the system proposed for use on this Project, and that any deviations or differences between the tested mock-up and the Project system would not have resulted in a reduction in the performance of the tested mock-up.
b. Test reports shall include adequate data for comparison of tested system to system being proposed for project including but not limited to; detailed description, material cut sheets for each product used, installation instructions, any deviation in material, detail or assembly methods from the proposed system, and other data as requested by the Design Professional.
c. Test reports shall include a description of the testing procedure including: every pre-test and test performed (whether passed or failed) step-by-step through the testing program, identification of reason for failure, any repair or remediation procedures performed after failed tests, any information collected from examination of mock-up after testing and during disassembly, and other data as requested by Design Professional. If the tested mock-up passed tests on initial attempt, indicate so in writing.

2. Show compliance with indicated criteria:

a. Quality Control Program.
b. Quality Control Documentation.
c. Welding qualifications and procedures.
d. Factory Test Procedures.
e. Factory Test Reports.
f. Field Test Procedures.
g. Field Test Reports.

H. Certifications: Indicated certification letters.

I. Closeout Submittals: Intent to Warrant Letter and draft of Warranty prior to start of fabrication or construction. Final Warranty after Date of Substantial Completion.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For glazed aluminum curtain walls to include in maintenance manuals.

B. Maintenance Data for Structural Sealant: For structural-sealant-glazed curtain walls to include in maintenance manuals. Include ASTM C 1401 recommendations for post-installation-phase quality-control program.

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1.6 SYSTEM DESCRIPTION

A. Design: Engineer system to perform in compliance with indicated criteria and to comply with indicated design intent.

1. Maintain basic dimensions of system, sight lines, jointing, and profiles. Minor variation is allowable only with approval of Design Professional and if variations are identified on submittals.

2. Engineer components of system not fully detailed within a reasonable inference of design intent.

B. Performance specifying permits system manufacturers latitude to adjust proprietary systems to achieve specified requirements. Rely on this article as basis for system criteria specifying and minimize material and component statements so not to conflict with performance criteria.

C. Following paragraphs represent a suggested listing of criteria. If more stringent criteria is being considered, refer to AAMA and ASTM test methods and associated documents for guidance.

D. Structural Requirements: Withstand loading and deflection criteria per Exterior Enclosure, General: Division 7.

E. Movement Requirements: Accommodate movement criteria per Exterior Enclosure, General: Division 7.

1. Two-sided and four-sided Structural Silicone Glazing: Comply with requirements of Glazing: Division 8.

F. Air and Water Requirements: Comply with criteria per Exterior Enclosure, General: Division 7.

G. Condensation Resistance: Comply with requirements of Aluminum Entrances and Storefront: Division 8.

H. Provide a system which eliminates the following:

1. Vibration harmonics, wind whistles or noises caused by thermal movement.
2. Thermal stress transmitted to other building elements.
3. Loosening, weakening, or fracturing of attachments or components of system.
4. Sealant or glazing gasket failure.
5. Transfer of stresses including those caused by thermal and structural movement to glass.

1.7 QUALITY ASSURANCE

A. Manufacturer's Qualifications:

1. Experience: Minimum five (5) years producing products similar to those required for this Project.
2. Manufacturing: Products shall be manufactured by company marketing product. Products manufactured by third parties for private labeling, by marketing company will not be allowed. Accessory products, as approved in writing by Design Professional, may be manufactured by Others.
3. Manufacturer's Design Engineer: Professional Engineer, licensed in Commonwealth of Kentucky and having a minimum of five (5) years' experience designing systems similar to those required for this Project. Design Engineer shall sign and seal calculations.
4. Single Source Requirements: Products shall be supplied by one (1) manufacturer. Accessory products including, for example, fasteners, sealants and anchors may be from other than primary manufacturer if approved in writing by primary manufacturer and Design Professional.
5. Certify compliance. Include project descriptions with Owner and Design Professional contacts for previous experience and resume for designer.

B. Installer's Qualifications:

1. Experience: Minimum five (5) years installing products similar to those required for this Project.
    a. Adequately trained by manufacturer and recommended in writing by manufacturer for type of installation required for this Project.
2. Certify compliance. Include project descriptions with Owner and Design Professional contacts for previous experience.

C. Welder's Qualifications:

1. Welding Procedures and Qualifications: In accordance with "Structural Welding Code, Steel", AWS D1.1.
2. Welders shall be qualified to perform the type of Work required.
3. Identification: Each welder shall be assigned an identification symbol and shall mark his identification at each shop and field weld.

D. Regulatory Requirements: Perform Work in compliance with AAMA: Aluminum Curtainwall Design Guide Manual.

E. Certifications: Manufacturer shall certify in writing the following:

1. Compliance with requirements of Exterior Enclosure, General: Division 7.
2. Use and Compatibility Certification: Certify that materials are appropriate for indicated use and that substrates and adjacent materials are compatible.

3. Certify installer qualifications.

4. Certify single source responsibility.

5. Certify acceptance of products manufactured by others.

6. Certify that curtainwall systems comply with specified requirements.

7. Certify that the system represented in the shop drawings and other submittals will result in, if installed as detailed, performance substantially the same as it did in the tests on which the manufacturer bases their predictions of performance for air and water resistance, thermal performance, condensation resistance, structural capacity and other salient performance criteria in compliance with the Contract Documents. Include the primary products, all accessories, interface and anchorage to adjacent construction and all other work of this section included in the submittals.

F. Mock-ups: Provide curtainwall required for mock-up specified in Exterior Enclosure, General: Division 7.

G. Manufacturer's Quality Control Program: Manufacturer shall establish a quality control program to ensure compliance with requirements. Submit plan for record. Manufacturer's existing quality control program may be acceptable if all requirements listed below are met.

1. Document each aspect of quality control plan including statistical data regarding compliance to tolerances. Plan shall include names of approved inspectors who shall initial each quality control inspection or check. Include qualifications of inspectors.

2. Manufacturer shall determine frequency of each type of inspection and checking, unless otherwise indicated.

3. Program shall include procedures which provide for the following:

   a. Manufacturers inspection and checking at each phase of Work including, but not limited to, checking of the following to assure compliance with Contract Documents, submittals and as required to match approved Samples and Shop Drawings.

      1) Raw materials upon delivery.

      2) Shipping, storage and handling of raw materials.

      3) Tolerance of materials cut to size and formed for fabrication.

      4) Sub-assemblies and fabricated units.

      5) Welds and welding procedures.

      6) Bolted or screwed mechanical anchors.

      7) Glazing procedures.

      8) Final assemblies before shipping.

      9) Packing, crating and shipping, storage and handling procedures.

      10) Materials as they are received, stored and handled at site.

      11) Substrates and structures to which curtainwall is attached.

      12) Each phase of installation.

   b. Record Keeping:

      1) Maintain a log and drawings of each assembly and its installed location.

      2) Maintain a log of the shipping weights of each assembly. Include the weight when the assembly was loaded for shipping at the factory and the weight of the assembly immediately before being installed.

   c. Manufacturers testing of assemblies in field.

1) Test watertight sub-sill flashing and sill members before installation of remaining framing by hosing all members continuously for approximately 10 minutes.

H. Preinstallation Meeting: Refer to Exterior Enclosure, General: Division 7.

I. Independent Inspection and Testing: Services of an independent Inspection and Testing Agency will be required in conjunction Work of this Section. Refer to Division 1.

1. Do not cover Work which is to be inspected or tested until directed.

1.8 DELIVERY, HANDLING AND STORAGE

A. Protect prefinished surfaces with wrapping or strippable coating. Do not use adhesives which bond or leave a residue.

B. Ship and store under conditions which will not have a deleterious effect on the finished work. Comply with written instructions of manufacturer of glass, glazing or other accessory product manufacturers.

C. Protect panels during shipping and storing to eliminate water from standing in locations which are not designed to hold standing water in the installed position.

D. Wrap panels to protect from weather and soiling during shipping and storing.

1.9 FIELD CONDITIONS

A. Environmental Requirements: Do not install sealants when ambient temperature is less than 40 degrees F during and 48 hours after installation.

B. Verify that field measurements are as indicated on Shop Drawings.

1.10 WARRANTY

A. General: Warranty shall not deprive Owner of rights under other provisions of Contract and shall be in addition to, and run concurrent with, other Warranties made by Contractor under requirements of Contract Documents.

B. Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of curtainwall that fail in materials or workmanship or fail to perform in accordance with specified criteria within specified Warranty Period.

1. Specified Warranty Period: Three (3) years from Date of Substantial Completion.

2. System Includes: Curtainwall, trim, brake metal, internal flashing, anchors, glass and glazing, accessories, and accessories and miscellaneous components.

3. Intent to Warranty: Submit certification of manufacturer's intent to provide Warranty at completion of construction and Sample of manufacturer's Warranty Form.

4. Warranty of system shall be maintained with the attachment of interior shade system brackets to interior of system.

C. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a) Color fading more than 5 Hunter units when tested according to ASTM D 2244.

b) Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.

c) Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Specified Warranty Period: Three (3) years from Date of Substantial Completion.

Part 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Products of indicated manufacturers are acceptable, contingent upon conformance to indicated requirements. Equivalent products of other manufacturers will be evaluated as substitutions in accordance with requirements of Division 1.

1. Basis of Design: Wausau Window and Wall Systems (Phone 715-846-3343).
2. YKK (Phone 678-838-6000).
3. SOTA Glazing Inc. (Phone 973-822-0400).
4. Schuco (Phone 860-666-0505).
5. Oldcastle Glass (Phone 866-653-2278).
6. McMullen Inc. (Phone 252-265-0009).
7. Efco Corporation (Phone 800-221-4169).

2.2 MATERIALS

A. Use adhesives and sealants that comply with the VOC limits specified in Sustainability Requirements: Division 1.

B. Use field applied paints and coatings that comply with the VOC limits and chemical restrictions specified in Sustainability Requirements: Division 1.

C. Aluminum: Alloy and temper to suit application.

1. Extruded Shapes and Tubes: ASTM B 221.
2. Sheet and Plate: ASTM B 209.
3. Structural Shapes: ASTM B 308.
4. Drawn Seamless Tube: ASTM B 210.
5. Castings: ASTM B 26, B 108 or B 85.
6. Welding Rod: AWS A 5.10.

D. Galvanized Steel Sheet: galvanized per ASTM A653/A653M to coating designation G60.

E. Steel Sections: ASTM A 36, galvanized after fabrication per ASTM A 123.

F. Structural Steel Tubing: ASTM A 500, Grade B, galvanized after fabrication per ASTM A 123.

G. Anchorage Clips and Fabrications: High-strength aluminum or nonmagnetic stainless steel or steel hot dip galvanized after fabrication per ASTM A 123.

H. Concrete Inserts: Cast-iron, malleable iron or steel hot dip galvanized after fabrication per ASTM A 123.

I. Continuous Adjustable Concrete Inserts: Stainless steel channels with welded anchor legs with special "tee" head bolts. Cap ends of channel or fill with foam to keep out wet concrete. Manufactured by Unistrut or Halfen.

J. Insulation: As specified in Building Insulation: Division 7.

K. Fasteners:

1. Contacting Aluminum and Dissimilar Metals: Stainless steel, ASTM F 593 and F 594, Alloy Group 1, finish to match adjacent surface if exposed.

2. Contacting Steel or Galvanized Steel Only: Hot dip galvanized steel conforming with ASTM B 633, SC 4 or ASTM A 153.

L. Coatings:

1. Shop Primer for Steel: SSPC-Paint 20.

2. Touch-up Primer for Galvanized Steel: Primer with minimum 80 percent zinc in dry film complying with SSPC-Paint 20.

3. Dissimilar Metal Coating: Cold-applied asphalt mastic or other non-conductive, non-absorptive material.

M. Foam Tape: 9 pcf density (self-adhesive) foam tape with flame retardants to meet FMVSS 302 flammability standard. Norton V 780 or approved substitution. Provide tape [1 inch] {25 mm} wide, unless otherwise indicated by the following thickness.

1. Provide [1/8 inch] {3 mm} thick at metal panels, concrete or another smooth substrate.

2. Provide [1/4 inch] {6 mm} thick at masonry or similar rough substrate.

N. Butyl Coated Foam Tape: Soft, compressible PVC foam core encapsulated with 100 percent solids butyl. "Norex" by Norton or approved substitution. Provide [1/8 inch by 1/2 inch] {3 mm by 13 mm} tape, unless otherwise indicated.

O. Double Stick Tape: Closed-cell foam tape for structural bonding, 3M "VHB" Tapes or approved equivalent. Minimum peel adhesion of 15 pounds per inch. Use minimum thickness tape to provide hairline joints where exposed.

1. Primers, cleaning agents and accessories as recommended in writing by tape manufacturer.

2.3 CURTAINWALL FRAMING, GENERAL

A. System design is based on the "SuperWall" system manufactured by Wausau, subject to conformance to specified criteria. Modify standard system as required to comply.

B. Two (2) Stage Pressure-equalized Rainscreen Weatherproofing: System shall provide redundant weatherproofing (both internal to system and at interface of system with adjacent construction) to control infiltration of water and air which may bypass outer rainscreen weatherseal and to maintain continuity of inner air barrier/vapor retarder by means of pressure-equalized cavities.

1. System shall be weathertight at interior face of glazing and interior face of glazing pocket. Water that may penetrate outer glazing seal shall be weeped to exterior. Provide weeps in pressure bar and mullion caps as indicated in documents.

2. Systems which require blind seals, seals that cannot be tooled in their final location, or other seals which do not comply with SWRI recommendations and which are required to maintain the performance of the air barrier, even if such conditions have adequately passed laboratory testing, will not be allowed.

3. Do not allow water to puddle or stand. Surfaces shall be pitched towards drains or weeps.

4. Where abutting adjacent construction, the system shall be capable of:

   a. Accepting an inner line of air barrier membrane flashing at the rear of the glazing pocket.
   b. Accepting sheet metal flashing and metal panel system trim for rainscreen at the outer face of the glazing pocket.

5. Sills shall have watertight sub-sills to direct water penetrating outer glazing seal or primary exterior sealant to exterior.

   a. Sub-sill shall have watertight end dams which intercept downward flow of water from space between inner and outer seals at jambs where system adjoins other exterior enclosure systems.

6. Air Barrier/Vapor Retarder: Inside face of glazing pocket and glazing forms a portion of air barrier/vapor retarder system for building envelope. Provide continuity of air barrier/vapor retarder across inner face of glazing pocket. Where vapor retarder is at a location other than the inside face of glass, detail system to maintain continuity of air barrier/vapor retarder across framing members, system and connection to adjacent air barrier/vapor retarder materials.

C. Frame: Tubular shaped extruded aluminum sections with minimum wall thickness of 0.125 inches for main members.

1. Furnish, for example, accessories, clips, stops and fillers.

2. Reinforce for structural performance and hardware.

3. Steel embedded within any portion of the curtainwall which may be exposed to moisture shall be galvanized.

D. Exterior frames shall be thermally improved to meet specified criteria. Interior frames need not be thermally broken if dimensions and profiles exactly match exterior frames.

2.4 VERTICAL GLAZING

A. Glazing System:

1. Glazing shall be removable from exterior.

2. Glazing shall be supported at top and bottom edges by frames and stops vertical edges shall be butt glazed.

B. Structurally silicone glazed systems shall provide for adhesion of the silicone to an alodine coated aluminum member unless the structural silicone glazing manufacturer approves alternative coatings on the substrate.

C. Provide filler panels to allow for back-up of full depth of sealant and backer rod where sealant is indicated or required to meet specified criteria.

D. Provide approximately 8-inch-long alignment tabs in extruded bosses or other similar devices acceptable to the Design Professional at the intersections of members to ensure alignment within indicated tolerances.

2.5 EXTERIOR TRIM

A. Exterior trim shall be extruded aluminum, minimum wall thickness 0.080 inch, except where indicated as "Brake Metal", profiles as indicated on Drawings.

B. Brake metal and other similar formed sheet fillers and trim shall be minimum 0.125-inch aluminum. Exposed finishes to match adjacent framing finishes.

C. Column and Beam Covers: Form from brake metal to profiles and shapes indicated. Furnish reveals, joints, base details and head details as indicated. Furnish framing to support covers as required to meet specified criteria.

D. Coping: Hook leading edge over continuous cleat. Anchor back edge with screws with neoprene washers in slotted holes 16 inches on center. At each joint provide a 12-inch-long back-up plate with each side bedded in mastic. Joints shall align with mullions.

2.6 INTERIOR TRIM

A. Interior trim shall be extruded aluminum minimum wall thickness 0.080 inch, finish to match exterior, unless otherwise indicated.

B. Furnish, for example, mullion covers, head trim, sill, stools, receiver for acoustical ceilings as indicated. Individual pieces shall be fabricated to snap together forming hairline joints.

C. Mullion Extensions: Formed sheet or extruded aluminum extensions to fill space between end of partition and mullion. Finish shall match mullion.

1. Anchor Channel at Mullion: 1 inch by 1 1/2 inch by 0.080 inch {25 mm by 38 mm by 2 mm} aluminum continuous.

2.7 DOORS

A. Doors are specified in Aluminum Entrances and Storefront: Division 8.

B. Frame at doors in curtainwall shall match profile of adjacent mullions and as indicated. Provide an extrusion to accept hinges and stops not more than 1 inch wide. When doors are indicated to be thermally broken provide a thermally broken extrusion. Do not set an additional sub-frame inside of curtainwall mullions. Reinforce curtainwall framing members for door and door Finish Hardware.

2.8 SHADOW BOXES

A. Solid Panels: Minimum 0.125-inch-thick aluminum panel with painted finish, reinforced to resist oil-canning.

B. Insulation: Semi-rigid, rock or slag mineral fiber, complying with ASTM C 612, including manufacturer's written recommended foil-tape, sealants and accessories.

C. Fabrication: Form front and back pan watertight to profiles indicated. Reinforce panels to comply with indicated criteria. Vent shadow box as indicated on drawings.

2.9 GLAZING

A. Glass and glazing are specified in Glazing: Division 8.

2.10 FLASHING

A. Flashing concealed within system shall be aluminum or stainless steel.

B. Concealed flashing where system abuts dissimilar materials shall be minimum 20 gage stainless steel.

C. Exposed flashing shall be aluminum, finished to match system, minimum 0.062 inch.

2.11 SEALANTS

A. Sealants within system shall be ASTM C 920 silicone or epoxy as recommended in writing by manufacturer.

B. Sealants for use where system abuts other construction shall be as specified in Joint Sealants: Division 7.

2.12 FABRICATION

A. Fabricate in compliance with approved submittals and field mock-up. Fabricate in compliance with specified criteria.

B. Form and assemble Work in shop to fullest extent possible. Indicate extent of such Work on Shop Drawings.

C. Fabricate Work to properly fit field-measured openings, without use of unscheduled closures or filler members. Wherever glazed, Work shall be suitable for glass and glazing. Use templates to prepare surfaces for Finish Hardware: Division 8, verifying hardware to final approved Hardware Schedule.

D. Coordinate this Work with glass and glazing work as specified in Glazing: Division 8.

1. Where feasible, install non-glazed panels in prefabricated frames at manufacturer's shop.

2. Where feasible and at Contractor's option, install glass in prefabricated frames at manufacturer's shop.

E. Fabricate curtainwall system to allow for adequate clearances around perimeter of system to enable proper installation.

F. Fabricate curtainwall components allowing for accurate and rigid fit of joints and corners. Match components carefully ensuring continuity of line and design. Comply with tolerances specified herein.

G. Fabricate curtain wall to accept sealing of air/vapor barrier membrane flashing into perimeter of glazing pocket. Mill out tongue of mullions and other interruptions to provide a continuous flat surface to bed membrane.

H. Flashing: Fabricate per Flashing and Sheet Metal: Division 7.

I. Allow moisture entering joints and condensation occurring within framing members to drain to exterior, provide weeping as necessary for positive drainage.

J. Conceal fastenings and reinforcements in Finished Work.

K. Grind welds smooth on exposed surfaces prior to finishing.

L. Uniformity: Abutting members shall not have an integral texture or color variation greater than half the range indicated in approved Samples.

2.13 FINISHES

A. General:

1. Shop finish Work, including priming of surfaces not to be exposed to view in Final Work.

2. Finish aluminum curtainwall at interior and exterior faces to match other adjacent components, unless indicated otherwise.

B. High Performance Organic Coating: As specified in Fluoropolymer Coatings: Division 5.

2.14 SOURCE QUALITY CONTROL

A. Fabrication Tolerances:

1. General: Fabricate to tolerances as required to:

a. Match approved Mock-up.
b. Comply with performance criteria.
c. Comply with manufacturer's written instructions.
d. Achieve tolerances indicated for Final Work.
e. Align with other supported or adjacent Work with more stringent tolerances.

B. Independent Inspection and Testing: Comply with requirements of Exterior Enclosure, General: Division 7.

C. Comply with Quality Control Program.

Part 3 EXECUTION

3.1 EXAMINATION

A. Project Site Verification of Conditions:

1. Verify dimensions, tolerances, and method of attachment with other work.
2. Verify sills, wall openings and adjoining air and vapor seal materials are ready to receive Work of this Section.
3. Verify accurate benchmarks and layout control points.

B. Commencing installation of curtainwall constitutes acceptance of substrates.

3.2 PREPARATION

A. Provide items to be imbedded in concrete or welded to structural steel and coordinate required locations.

B. Attach anchor clips to structure per approved submittals and to maintain structural capacity of anchors. Shim clips only to allow for proper alignment. Do not shim excessively to accommodate inadequate range of adjustment in clip. Use shims large enough to not reduce structural capacity of anchor clip.

C. Isolate dissimilar metal surfaces with asphalt mastic; tape or gasket acceptable to Design Professional.

D. Isolate aluminum from contact with mortar, concrete or other masonry materials with an alkali-resistant material acceptable to Design Professional.

E. Isolate aluminum from contact with pressure preservative-treated wood with an alkali-resistant material acceptable to Design Professional.

F. Install base or sill flashing per Flashing and Sheet Metal: Division 7.

G. Sub-Sill: Set sub-sill flashing in a triple row of sealant. Anchor sub-sill using clips or anchors without penetrating horizontal portion of sub-sill. Seal all penetrations and anchorage points. Sub-sill shall be watertight. Provide foam tape between sub-sill and frame.

3.3 INSTALLATION

A. General: Install curtainwall as required to:

1. Comply with manufacturer's written instructions.
2. Comply with approved submittals.
3. Match approved field Mock-ups.
4. Comply with indicated criteria.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities and to allow for movement criteria. Weld or otherwise permanently secure adjustable anchors after final alignment.

C. Coordinate attachment and seal of perimeter air and vapor barrier materials.

D. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

E. Install doors.

F. Install copings and interior trim.

G. Install mullion extensions using double stick tape and concealed fasteners. No exposed fasteners allowed. Provide support at all edges of trim including head and sill. Fill cavity with mineral wool insulation.

H. Install shadow boxes per approved submittals. Vent shadow boxes in accordance with system manufacturer's recommendations.

I. Install tapes per manufacturers written instructions. Prepare and prime substrates.

J. Firesafing: Refer to Firestopping: Division 7.

K. Glass and Glazing: Refer to Glazing: Division 8.

L. Joint Sealants and Joint Fillers: Refer to Joint Sealants: Division 7.

M. Install components plumb, level, accurately aligned, and located in reference to column lines and floor levels within tolerances indicated.

3.4 ERECTION TOLERANCES

A. General: Comply with more stringent tolerances than those listed below, if required to:

1. Match approved field Mock-ups.
2. Comply with performance criteria.
3. Comply with manufacturer's written instructions.
4. Align with other supported or adjacent Work with more stringent tolerances.

B. Limit variations from plumb, level or dimensioned angle to the following:

1. 1/8-inch maximum deviation in any story height, or in any 10 feet vertical or angular run, or in any 20-foot horizontal run, non-cumulative.
2. 1/4-inch maximum deviation in any 40-foot run, any direction, non-cumulative.

C. Limit variations from location (theoretical calculated positions in plan or elevation based on established floor lines and column lines), including variations from plumb and level, to the following:

1. 1/4-inch total maximum deviation for any element at any location, non-cumulative.
2. 1/4-inch maximum change in deviation for any element for any 10-foot run, any direction, non-cumulative.

D. Limit offset in end-to-end or edge-to-edge alignments of adjoining consecutive elements indicated to be flush, continuous or planar to the following:

1. Interior: 1/32 inch.
2. Exterior: 1/16 inch

E. Limit variation from indicated position in end-to-end or edge-to-edge alignments of adjoining consecutive elements indicated to be less than 1/2 inch out-of-plane or are separated by a maximum 2 1/2 inch wide member to the following:

1. Interior: 1/16 inch.
2. Exterior: 1/8 inch.

F. Limit variation from indicated position in end-to-end or edge-to-edge alignments of adjoining consecutive elements indicated to be 1/2 inch or more out-of-plane or are separated by a member wider than 2 1/2 inches to the following:

1. Interior: 1/8 inch.
2. Exterior: 3/16 inch.

G. Limit maximum width of a hairline joint as follows:

1. Interior: 0.020 inch.
2. Exterior: 0.050 inch.

H. Limit maximum variation in width of a hairline joint as follows:

1. Interior: 0.005 inch.

2. Exterior: 0.020 inch.

I. Limit difference in diagonal measurements to 1/8 inch.

J. Metal panels, trim and brake metal shall not have visible oil canning, pinching, dimples or other surface irregularity or deformation visible when viewed under the following conditions:

1. Viewed at any angle.
2. Viewed from a distance of 10 feet from exterior surfaces and 3 feet from interior surfaces.
3. Viewed between two (2) hours after sunrise and two (2) hours before sunset for exterior surfaces.
4. Interior work shall be viewed under normal building lighting (natural or artificial) conditions.

K. Comply with stricter tolerances if required for glazing or to meet specified performance criteria.

3.5 FIELD QUALITY CONTROL

A. Comply with requirements of Quality Control Program.

3.6 ADJUSTING

A. Adjust doors for smooth operation.

B. Touchup damage to prefinished surfaces with approved matching touch up paint.

3.7 CLEANING

A. Clean completed system, inside and out, promptly after erection and installation of glass and sealants, allowing for nominal curing of liquid sealants.

B. At Date of Substantial Completion, clean curtainwall system thoroughly and polish glass. Demonstrate proper cleaning methods and materials to Owner's maintenance personnel.

3.8 PROTECTION

A. Protect Finished Work from damage

END OF SECTION 084413

SECTION 087100 **FINISH HARDWARE**

Part 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY (NON-INCLUSIVE)

A. This Section references specification sections relating to commercial door hardware for the following:

1. Swinging doors.
2. Sliding Doors.
3. Other doors to the extent indicated.

B. Commercial door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical and access control door hardware.
3. Electromechanical and access control door hardware power supplies, back-ups and surge protection.
4. Automatic operators.
5. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 8 Section "Standard Hollow Metal Doors and Frames".
2. Division 8 Section "Wood Doors".
3. Division 8 Section "Aluminum Entrances and Storefronts".

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. State Building Codes, Local Amendments.

E. Standards: Reference Related Sections for requirements regarding compliance with applicable industry standards.

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

3. Content: Include the following information:

   a. Type, style, function, size, label, hand, and finish of each door hardware item.
   b. Manufacturer of each item.
   c. Fastenings and other pertinent information.
   d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
   e. Explanation of abbreviations, symbols, and codes contained in schedule.
   f. Mounting locations for door hardware.
   g. Door and frame sizes and materials.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Keying Schedule: Prepared under the supervision of the Owner, separate schedule detailing final keying instructions for locksets and cylinders in writing. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner to approve submitted keying schedule prior to the ordering of permanent cylinders.

D. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 1. The manual to include the name, address, and contact information of the manufacturers providing the hardware and their nearest service representatives. The final copies delivered after completion of the installation test to include "as built" modifications made during installation, checkout, and acceptance.

F. Warranties and Maintenance: Special warranties and maintenance agreements specified in the Related Sections.

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1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Installer Qualifications: Installers, trained by the primary product manufacturers, with a minimum 3 years documented experience installing both standard and electrified builders hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor in good standing by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

D. Source Limitations: Obtain each type and variety of Door Hardware specified in the Related Sections from a single source, qualified supplier unless otherwise indicated.

E. Regulatory Requirements: Comply with NFPA 70, NFPA 80, NFPA 101 and ANSI A117.1 requirements and guidelines as directed in the applicable model building code.

F. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 1 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1.5 DELIVERY, HANDLING AND STORAGE

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door and Frame Preparation: Division 8 Sections doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

A. General Warranty: Reference Division 1, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

Part 2 PRODUCTS

2.1 KEYING

A. Verify all keying requirements and procedures with the Owner during the Bidding Phase. Procurement, keying, and installation of cylinders

B. During the construction, Contractor shall provide and use temporary cores (to be returned to Contractor) for construction keying. Contractor shall assist with changeover installation of the final cylinders.

C. Provide the exact same keying system for ALL locking devices.

2.2 HARDWARE ITEMS

A. Hinges:

1. Manufacturers: Stanley, Ives, McKinney, Hager, Markar, or equivalent.
2. Products: Full mortise, 4.5-inch-wide, ball bearing, with non-removable pins (NRP) at reverse bevel locked doors. Finish shall be satin stainless steel (630).
    a. Ballbearing Hinges: FBB-191.
    b. Spring Hinges: Stanley 2060R
    c Offset Pivot Hinges (for Aluminum doors): Ives 7215 series (or equivalent) heavy duty 3/4 inch offset, satin stainless steel. Coordinate with aluminum door manufacturer. Finish shall be dark bronze to match curtainwall.
    f. Pocket Pivots (for hollow metal doors): Rixson F519 in satin stainless steel.
    g. Power Transfer (non-bearing): See Panic Devices.
3. Application/Size: Use 3 butts per leaf on doors up to 7 feet 6 inches high, and one additional for each added 18 inches height. Hinge height to be 4.5 inches for doors up to 36 inches wide, 5 inches for doors between 36 inches to 48 inches, and continuous type for all openings 48 inches and larger, and as otherwise indicated.

B. Locks/Latches:

1. Manufactuer / Series: Owner Standard Series: Best Access 9K series, with #16L lever/rose.
    a. Coordinate owner's required core / keyway with owner.
    b. Provide tactile knurled lever at Electrical Room.
    c. Finish shall be Best 630 Satin Stainless Steel.
2. Application / Functions Best:
    a. PASSAGE
    b. OFFICE
    c. STOREROOM
    d. CLASSROOM
    e. PRIVACY
    f. EXIT
3. Keyless locks / latches:
    a. Coordinate with Security Vendor for keyless SALT lock where indicated.

C. Exit Devices:

1. Manufacturers: VonDuprin 98 / 35A series.
    a. Other panic devices will be considered as substitutions in accordance with Div 1.
2. Products: Push pad touch bar (smooth case) exit devices, UL listed for fire and/or panic use, with proper strikes for each application. Finishes shall be dark bronze.
3. Applications:

a. Product lines:
    1) HM / WOOD / Mortise: 9875
    2) HM Concealed Vertical Rod: 9847A/48A
    3) ALUMINUM Concealed Vertical Rod: 3547A/48A (thin line)
    4) ALUMINUM Rim: 35A (thin line)

b. Accessories, Options, Codes:
    1) L: Lever
    2) L-NL: Leverlock STOREROOM function (always locked)
    3) BE: Blank Escutcheon (no key – PASSAGE function)
    4) NL-OP: "Nightlatch" Key Retracts Latchbolt (supplemental pull used)
    5) EL: Electric Latch Retraction (pullback)
    6) RX: Request-to-Exit switch (in touch bar)
    7) F: UL listed (for all fire rated openings)
    8) Power Transfer (non-bearing): EPT-10
    9) Power Control Units: PS-873 series, with all options, cards, and accessories required for proper functions at each application
    10) LX: Latchbolt Monitor Switch (for opener coordination)

D. Closers:

1. Manufacturers / Series: LCN 4040XP series
    a. Other panic devices will be considered as substitutions in accordance with Div 1.
2. Products: Rack and pinion hydraulic mechanism with compression spring, non-sized, fully adjustable from size 1 to 6, ADA force compliant, with separate sweep / latching / backcheck controls. Provide full design plastic cover for surface closers, with painted arms. Closers shall have a ten (10) year warranty. Provide drop plates at glass lite doors when required. Provide stoparm (parallel) closer mounting as indicated, regardless of (in/out) side of Room.
    a. Through bolting shall not be permitted.
3. Application / Functions:
    a. Regular Arm: 4040XP
    b. Parallel Arm (EDA/forged): 4040XP-EDA
    c. Parallel Arm w/stop shoe: 4040XP-CUSH
    d. Delay Action: DA
4 Special Applications:
    a. Dual Unit Concealed Overhead Power Assisting (ADA) LCN 2610 series pneumatically powered low energy operator (concealed in frame head)
    1) Provide ES7982 control box with integral self-contained compressor (which will operate inner and outer doors, and interface with inner door access control when required). Provide all tubing and accessories required for proper operation.
    1) Provide stainless steel ADA actuators, as indicated on drawings.
    2) Coordinate card reader activation.

E. Electronic Hardware:

1. Maglock (shear): Schlage (Locknetics) GF3000 mortised shear lock (or equivalent) w/door status and magnetic bond sensors (DSM / MBS)

a. Provide power control units as required, with all interfaces needed for proper operation. Coordinate with card reader and alarm systems, and autoswing operator (at ADA entry)
b. Provide Battery Backup power (as requested by Owner – code approved by Owner Rep)
c. Provide Emergency Release Stations (631 or comparable). Before submitting in hardware shops (state such approval IN the shop submission).

3. Monitor Switches (coordinate w/Security Contractor): Sentrol 1076- CW, or other to match Security Contractor's standard. Shop prep doors and frames as required.

F. Plates / Pulls:

1. Manufacturers: Rockwood, Hager, Burns, or equivalent.
2. Products:
   a. Special Vertical PUSH / PULL Bars (single and combination): Rockwood RM7210 dark bronze. Coordinate mounting height to meet ADA. Mount to clear panic device rods and cylinder when required.
   c. Kickplates: 0.050 inch satin stainless steel BHMA 630, bevel edges, 8 inches high, 2 inches less door width, (1 inch LDW@ pairs).
3. Application: Use concealed mountings wherever possible. SURFACE FASTENERS SHALL BE COUNTERSUNK STAINLESS-STEEL SCREWS. BEVEL ALL EDGES OF ALL PLATES.

G. Door Seals/Thresholds:

1. Manufacturers: Reese, Pemko, National Guard (NGP), Hager, Zero, or equivalent.
2. Products:
   a. Smoke Seals: 797-B (black self-adhesive bulb).
   b. Threshold (LOW): S483-APR (w/bumper).
   c. Astragal (T-seal): 275.

H. Miscellaneous Items:

1. Door Stops:
   a. Overhead Stops: Medium duty, Glynn Johnson or equivalent, 410 series (concealed) satin stainless steel.
   b. Wall Stop: Ives, or equivalent, FS-438, satin chrome plated.
2. Flushbolts: Ives, or equivalent, satin chrome 626, with dust proof bottom strikes.
   a. Automatic: FB-31P (set).
3. Coordinator: Ives, or equivalent, 900 series, USP (primed), with filler tubes and brackets.
4. Silencers: Ives 20, or equivalent.
5. Cylinders: Provide master keyed cylinders at all locking devices, types to suit applications.

Part 3 EXECUTION

3.1 DELIVERY AND PACKAGING

A. Finish Hardware shall be delivered to the site properly assorted, labeled and boxed or packaged, complete with all trimmings, screws, anchors, and other accessories. Each item shall be marked with item number and door number.

3.2 INSTALLATION

A. Verify that all doors and frames are ready to receive the hardware.

B. Verify that the power supply is available to all electrically operate devices.

C. Beginning of installation means acceptance of existing conditions.

3.3 INSTALLATION

A. Repair damaged and defective.

3.4 ADJUSTING AND CLEANING

A. Repair damaged and defective.

3.5 SCHEDULE OF FINISH HARDWARE GROUPS

HG-1A CR / ALUM / ACCESS CONTROL VESTIBULE (EXTERIOR)

Each Pair Doors: 100A.1

2 sets Offset Pivot Hinges
2 Power Transfer Hinges (non-bearing, NOT electric hinge)
2 Panic Devices (thin line): CONCEALED VERTICAL ROD NIGHTLATCH (key retracts latch) w/Electric Latch Retraction & RX switch
1 Power Control Unit (for Panic Devices)
2 Special Vertical PULL Bars (mount to clear cylinders & rods)
1 Closer: Dual Automatic unit (in head tube) w/actuators
1 Threshold w/bumper (LOW)
2 Monitor Switches

Weatherstripping / sweep by door manufacturer
Card reader by others
Coordinate Retracting Panic Devices / Card Reader
Coordinate Autoswing Operator w/ retracting devices / Card Reader actuation
*All hardware finishes to be dark bronze to match alum door.

HG-1B CR / ALUM / ACCESS CONTROL VESTIBULE (INTERIOR)

Each Pair Doors: 100A.2

2 sets Offset Pivot Hinges
2 Power Transfer Hinges (non-bearing, NOT electric hinge)
2 Panic Devices (thin line): CONCEALED VERTICAL ROD NIGHTLATCH (key retracts latch) w/Electric Latch Retraction & RX switch
1 Power Control Unit (for Panic Devices)
2 Special Vertical PULL Bars (mount to clear cylinders & rods)
1 Closer: Dual Automatic unit (in head tube) w/actuators
1 Threshold w/bumper (LOW)
2 Monitor Switches

Weatherstripping / sweep by door manufacturer
Card reader by others
Coordinate Retracting Panic Devices / Card Reader
*All hardware finishes to be dark bronze to match alum door.

HG-2 **ALUM / CR** **CORRIDOR (EXTERIOR)**

Each Single Door: 106

1 set Offset Pivot Hinges
1 Power Transfer Hinge (non-bearing, NOT electric hinge)
1 Panic Device (thin line): RIM NIGHTLATCH (key retracts latch) w/Electric Latch Retraction & RX switch
1 Power Control Unit (for Panic Devices)
1 Special Vertical PULL Bar (mount to clear cylinder)
1 Closer: Concealed in Head (Offset SINGLE acting)
1 Threshold w/bumper (LOW)
1 Monitor Switch

Weatherstripping / sweep by door manufacturer
*Coordinate card reader w/ security vendor.
*Coordinate Retracting Panic Devices / Card Reader
*All hardware finishes to be dark bronze to match alum door.

HG-3 **CR** **DANCE STUDIO ENTRANCE**

Each Pair Door: 102.1, 101

2 set Ballbearing Hinges NRP
1 each Dust Proof Strike
2 each flush bolt
1 each keyless SALTO lock (University Standard)
1 each keyless SALTO lock cylinder (University Standard)
1 Closer
1 Astragal

Perimeter gasketing and drop seals by door manufacturer
*Coordinate keyless SALTO lock with security vendor.
*All hardware finishes to be satin stainless steel.

HG-4 **DANCE STUDIO VESTIBULE**

Each Pair Door: 101.1

2 set Ballbearing Hinges NRP
1 each Dust Proof Strike
2 each flush bolt
1 each classroom lock
1 Closer
1 Astragal

Perimeter gasketing and drop seals by door manufacturer
*All hardware finishes to be satin stainless steel.

HG-5 **DANCE STUDIO EGRESS**

Each Single Door: 101.2, 102.2

1 set Ballbearing Hinges
1 Exit lock (no re-entry trim)

1 Closer: Parallel EDA Arm
1 set weatherstripping
1 Threshold (low)
1 Door Bottom Drip
1 Rain Drip (at head)

*Doors to be alarmed. Coordinate alarm with security vendor.
*All hardware finishes to be satin stainless steel.

HG-6 **CR** **TOILET ROOM / FACULTY CHANGING**

Each Single Door: 107, 109

1 set Ballbearing Hinges
1 each keyless SALTO lock (University Standard)
1 each keyless SALTO lock cylinder (University Standard)
1 Closer: Parallel EDA Arm
1 Wall Stop
3 Silencers

*Coordinate keyless SALTO lock with security vendor
*All hardware finishes to be satin stainless steel.

HG-7 **CR** **JANITOR CL, STOR, IT ROOM**

Each Single Door: 104,105,108

1 set Ballbearing Hinges
1 each keyless SALTO lock (University Standard)
1 each keyless SALTO lock cylinder (University Standard)
1 Closer: Parallel EDA Arm
1 Wall Stop
3 Silencers

*Coordinate keyless SALTO lock with security vendor
*All hardware finishes to be satin stainless steel.

HG-8 **ELECTRIC ROOM**

Each Single Door: 116

1 set Ballbearing Hinges
1 each Storage lock
1 Closer: Parallel EDA Arm
1 Wall Stop
3 Silencers

*Provide knurling on lever.
*All hardware finishes to be satin stainless steel.

HG-9 **CR** **OFFICE CORRIDOR**

Each Single Door: 110

1 set Ballbearing Hinges
1 each keyless SALTO lock (University Standard)
1 each keyless SALTO lock cylinder (University Standard)
1 Closer: Parallel EDA Arm
1 Wall Stop
3 Silencers

*Coordinate keyless SALTO lock with security vendor
*All hardware finishes to be satin stainless steel.

HG-10 **CR** **OFFICE**

Each Single Door: 111, 112, 113, 114

1 Special locking vertical pull bar.

*Coordinate hardware to be provided by glass wall manufacturer.
*All hardware finishes to be satin stainless steel.

END OF SECTION 087100

SECTION 088000 GLAZING

Part 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Applicable Sections: Division 1.

C. Exterior Enclosure, General: Division 7.

D. Aluminum Entrances and Storefronts: Division 8.

E. Safety Glass Doors and Sidelights (Frameless): Division 8.

F. Aluminum Curtainwall: Division 8.

1.2 SUMMARY (NON-INCLUSIVE)

A. Section Includes: Shop or Project Site installed glazing for exterior and interior applications not otherwise specified, as follows.

1. Storefront units and strip-window units.
2. Vision lites, including interior doors, and side lites.
3. Glazed curtainwalls.
4. Entrance doors.
5. Interior storefront construction.
6. Unframed mirrors.
7. Lobby and elevator accent glass.
8. Urinal access panel glass.

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. IBC: International Building Code.

D. Interspace: Space between lites of an insulating-glass unit.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

B. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

C. Review temporary protection requirements for glazing during and after installation.

1.5 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.6 SUBMITTALS

A. Submit per the requirements of Division 1.

B. Product Data:

1. For Each Glass Type Specified: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements, and published installation instructions.

2. For Each Glazing Material Specified: Provide published chemical, functional, and environmental characteristics, installation instructions, limitations, and special application requirements. Identify available colors.

3. For Fully Tempered Glass: Manufacturers certification that fully tempered units are either warranted without heat soaking or heat soaking is provided.

C. Samples:

1. Two Samples, 12 inches by 12 inches for each type and thickness of glass. Insulated units shall be fabricated in accordance with Specifications.

2. Identify each Sample, marks shall match Glazing Schedule.

D. Qualifications: Proof of compliance with indicated qualifications.

E. Quality Control Procedures:

1. Test Reports:

   a. Compatibility and Adhesion Test Reports: From manufacturer indicating that glazing materials and structural silicone glazing materials were tested for compatibility and adhesion. Include manufacturer's published interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed for adhesion.
   b. Compatibility test report from manufacturer of insulating glass edge sealant indicating that glass edge sealants were tested for compatibility with other glazing materials including sealants, glazing tape, gaskets, setting blocks, and edge blocks.

2. Test Reports and Procedures indicating compliance with indicated criteria:

   a. Factory Quality Control Procedures.
   b. Factory Test Procedures.
   c. Factory Test Reports.

F. Certifications: Product certificates signed by glazing materials manufacturers certifying that products comply with specified requirements, meet structural criteria and are appropriate for intended use.

G. Sustainability Submittals: Provide the following in accordance with Sustainability Requirements: Division 1.

1. Materials Sustainability Documentation Form.

2. Product data and costs for regional materials.

3. Product data for adhesives and sealants indicating VOC content.

H. Closeout Submittals:

1. Warranty: Intent to Warrant Letter and draft of Warranty prior to start of fabrication or construction. Final Warranty after Date of Substantial Completion.

2. Maintenance Data: For glass and other materials to be included in Operation and Maintenance Manuals specified in Division 1.

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1.7 DEFINITIONS

A. Interspace: Space between lites of an insulating glass unit.

B. Deterioration of All Glass Types: Defects developed from normal use that are attributed to manufacturing process or installation methods. Defects include (non-inclusive) flatness and other dimensional tolerances, distortion, tong marks, roller wave, bulls eyes, edge chips, cracks and other visible defects beyond those allowed by reference standard. Additional criteria (non-inclusive):

1. Deterioration of Fully Tempered Glass: Defects include spontaneous breakage caused by nickel sulfide inclusion.

2. Deterioration of Coated Glass: Defects include adhesion failure, peeling, cracking, and other indications of deterioration in coating.

3. Deterioration of Laminated Glass: Defects include edge separation, delamination, color change, and blemishes.

4. Deterioration of Insulating Glass: Defects include failure of structural sealant, failure of hermetic seal, obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1.8 SYSTEM DESCRIPTION

A. Design: Provide Final Design and engineering of glass and glazing in compliance with indicated design intent and criteria.

1. Maintain basic dimensions of system, sight lines, jointing, and profiles. Minor variation is allowable only when variations are identified on submittals and are approved by Design Professional.

2. Design and engineer components of system not fully detailed within a reasonable inference of design intent.

B. Glass Design: Glass thicknesses indicated are minimums for detailing convenience only. Confirm glass thicknesses by analyzing in-service conditions, thermal stresses and loading criteria indicated. Provide glass lights for various size openings in thicknesses and strengths (annealed or heat-treated) to meet or exceed the following criteria:

1. Determine minimum thickness of monolithic annealed glass according to ASTM E 1300. For other than monolithic annealed glass, determine thickness per glass manufacturer's standard method of analysis including applying adjustment factors to ASTM E 1300 based on type of glass.

2. Minimum glass thickness, nominally, of lights in exterior walls is [0.23 inch] {6.0 mm}.

3. Glass thicknesses, including glass used to make up insulating units, shall be same throughout Project to provide color and optical uniformity.

4. Probability of Breakage for Vertical Glazing: Maximum eight lights per 1000 for lights set vertically or not over 15 degrees off vertical and under wind action.

a. Load Duration: 60 seconds.

C. Structural and Thermal Movement Criteria: In accordance with Exterior Enclosure, General: Division 7.

D. Structural Silicone Glazing: Comply with the following:

1. Glazing to Glazing Joints: Designed to accommodate thermal and mechanical movement, prevent glazing contact with adjacent materials or other glazing, and maintain required edge clearances.
2. Isolation: Thermally and physically isolate glazing from metal framing.
3. Tensile and Shear Stresses in Silicone Joints: Maximum design stress of 20 psig.
4. Gravity Loads: Structural silicone shall not carry gravity load of glazing.
5. Adhesion: Sealant shall fail cohesively before failure to adhere to substrate when tested with each substrate and joint condition.
    a. Adhesion failure occurs when sealant pulls away from substrate cleanly leaving little or no sealant material behind.
    b. Cohesion failure occurs when sealant breaks or tears within sealant but remains bonded to substrates.

E. Thermal and Optical Performance Properties: Provide glass with performance properties based on manufacturer's published test data, as determined according to the following procedures:

1. For monolithic glass lites, properties are based on units with lites [1/4 inch] {6 mm} thick, unless indicated otherwise.
2. For laminated glass lites, properties are based on products of construction indicated.
3. For insulating glass lites, properties are based on units with [1/4 inch] {6 mm} thick lites and a nominal [1/2 inch] {13 mm} wide interspace.
4. Center of Glass U-values: NFRC 100 methodology using LBL-35298 WINDOW 4.1 computer program, expressed as [Btu/ square foot by hour by degree F] {W/square meter by K}.
5. Center of Glass Solar Heat Gain Coefficient: NFRC 200 methodology using LBL-35298 WINDOW 4.1 computer program.
6. Solar Optical Properties: NFRC 300.

1.9 QUALITY ASSURANCE

A. Manufacturer's Qualifications:

1. Experience: Minimum five (5) years producing products similar to those required for this Project.
    a. Provided products for three (3) projects of scope, schedule and complexity similar to this Project within last two (2) years as acceptable to Design Professional.
    b. Manufacturer of glass products shall be certified to ASTM ASQC 9001 or ISO 9001.
2. Manufacturer's Designer: Professional Engineer with minimum five (5) years' experience designing systems similar to those required for this Project.
3. Single Source Responsibility for Glass: Obtain tinted float glass, coated float glass, laminated glass and insulating glass from single source from single manufacturer for each glass type.
4. Single Source Responsibility for Glazing Materials: Obtain glazing materials and accessories from one source for each product and installation method indicated.
5. Certify compliance. Include project descriptions with Owner and Design Professional contacts for previous experience and resume for designer.

B. Installer's Qualifications:

1. Experience: Minimum five (5) years installing products similar to those required for this Project.

C. Glass Testing Agency's Qualifications: Obtain glass test reports from an independent Testing Agency with experience and capability to conduct testing indicated, as documented according to ASTM E 548.

D. Regulatory Requirements:

1. Safety Glazing: Comply with applicable codes, ANSI Z97.1 and CPSC 16 CFR, Part 1201 for all glazing in areas subject to human impact, including wire glass.

2. Labeling: Each individual light shall bear manufacturer's etched or fired label designating type, thickness and size, standard compliance and SGCC identification number (where applicable).

   a. Labels shall not be omitted, unless approved and an affidavit is furnished by Contractor certifying that each light is glazed in accordance with Contract Documents.
   b. Labels shall not be omitted from safety glazing materials, except for spandrel glass which shall be affixed with a removable paper label in lieu of etched or fired labels.

E. Referenced Codes and Standards: Comply with the following in accordance with Division 1.

1. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, except where more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in Referenced Standards.

   a. GANA Publications:

      1) "Glazing Manual".

      2) "Laminated Glass Reference Manual".

   b. IGMA Publications:

      1) TM-3000: "Vertical Glazing Guidelines".

2. American Architectural Manufacturers Association (AAMA)

   a. CW 13: Structural Sealant Glazing Systems (A Design Guide)

F. Certifications: Manufacturer shall certify in writing the following:

1. Compliance with requirements of Exterior Enclosure, General: Division 7.

2. Use and Compatibility Certification: Certify that materials are appropriate for indicated use and that substrates and adjacent materials are compatible.

3. Certify Installer's qualifications.

4. Certify single source responsibility.

5. Certify that glazing products comply with specified requirements.

6. Insulating Glass Certification Program: Provide insulating glass units permanently marked either on spacers or at least one component light of units with appropriate certification label of Inspecting and Testing Agency indicated below:

   a. Insulating Glass Manufacturers Alliance (IGMA).

G. Mock-ups: Provide glazing required for mock-up specified in Exterior Enclosure, General: Division 7.

H. Glazier's Quality Control Program: Glazier shall establish a quality control program to ensure compliance with requirements. Submit plan for approval by Design Professional. Include dates for all testing procedures and notify Design Professional one week in advance. Glaziers quality control program may be incorporated into Manufacturers Quality Control Program specified in Aluminum Curtainwall: Division 8.

1. Document each aspect of quality control plan, including statistical data regarding compliance to tolerances. Plan shall include names of approved inspectors who shall initial each quality control inspection or check. Include qualifications of inspectors.

2. Manufacturer shall determine frequency of each type of inspection and checking, unless otherwise indicated.

3. Program shall include procedures which provide for the following:

   a. Glaziers inspection and checking at each phase of Work including, but not limited to, the following:

1) Checking of raw materials upon delivery.

2) Checking as materials are cut to size and formed for fabrication.

3) Checking substrates for preparation, cleaning and priming.

4) Checking of glazing procedures.

5) Checking of each phase of installation.

I. Preconstruction Compatibility and Adhesion Testing: Glazing sealant manufacturer shall conduct compatibility and adhesion testing. Submit to glazing sealant manufacturers Samples of each glass, gasket, glazing accessory, and glass-framing member that will contact or affect glazing sealants as indicated below:

1. Structural silicone glazing products manufacturer shall perform adhesion tests as specified herein.

2. Use test methods standard with sealant manufacturer to determine if priming and other specific preparation techniques are required for rapid, optimum glazing sealants adhesion to glass and glazing channel substrates.

3. Perform tests under normal environmental conditions during installation.

4. Submit not less than nine pieces of each type and finish of glass-framing members and each type, class, kind, condition, and form of glass (monolithic, laminated, insulating units) for adhesion testing, as well as one Sample of each glazing accessory (gaskets, setting blocks and spacers) for compatibility testing.

5. Schedule sufficient time to test and analyze results to prevent delay in Work.

6. Investigate materials failing compatibility or adhesion tests and get sealant manufacturer's written recommendations for corrective measures, including using special primers.

7. Testing is not required when glazing sealant manufacturer can submit required preparation data that is acceptable to Design Professional and is based on previous testing of current sealant products for adhesion to and compatibility with submitted glazing materials.

J. Preinstallation Meeting: Refer to Exterior Enclosure, General: Division 7.

K. Inspection and Testing: Services of an Inspection and Testing Agency are required in conjunction with Work of this Section. Refer to Division 1.

1.10 DELIVERY, HANDLING AND STORAGE

A. Protect glazing materials to comply with manufacturer's written directions and as required to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Where insulating glass units shall be exposed to substantial altitude changes, comply with insulating glass fabricator's written recommendations for venting and sealing to avoid hermetic seal ruptures.

C. Mark each piece of glass before shipping with a removable label to identify glass type, exterior side (if applicable) and installation location.

1.11 FIELD CONDITIONS

A. Environmental Requirements: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits recommended by glazing materials manufacturer or when glazing channel substrates are wet from rain, frost, condensation or other causes.

B. Install liquid sealants at ambient and substrate temperatures above 40 degrees F.

1.12 SPECIAL WARRANTY

A. General: Warranty shall not deprive Owner of rights under other provisions of Contract and shall be in addition to, and run concurrent with, other Warranties made by Contractor under requirements of Contract Documents.

B. Manufacturer's Warranty on Coated Glass Products: Provide written Warranty signed by coated glass manufacturer agreeing to furnish replacements for coated glass units that deteriorate as defined in Article, Definitions.

1. Warranty Period: Ten (10) years after Date of Manufacture.

C. Manufacturer's Warranty on Laminated Glass: Provide written Warranty signed by insulating glass manufacturer agreeing to furnish replacements for those laminated glass units that deteriorate as defined in Article, Definitions:

D. Warranty Period: Five (5) years after Date of Manufacture.

E. Manufacturer's Warranty on Insulating Glass: Provide written Warranty signed by manufacturer of insulating glass agreeing to furnish replacements for insulating glass units that deteriorate as defined in Article, Definitions:

F. Warranty Period: Ten (10) years after Date of Manufacture.

G. Manufacturer's Warranty on Structural Silicone Glazing: Provide written Warranty signed by manufacturer of structural silicone agreeing to replace structural silicone sealants not performing to specified criteria.

1. Warranty Period: Five (5) years after Date of Substantial Completion.

H. Installer's Warranty: Provide written Warranty signed by installer of glass agreeing to install replacements for glass units that deteriorate as defined in Article, Definitions or units that are chipped, broken or otherwise defective because of faulty installation.

1. Warranty Period: Three (3) years after Date of Substantial Completion.

Part 2 PRODUCTS

2.1 MANUFACTURERS

A. Any of the following manufacturer complying with indicated criteria:

1. Viracon Inc.
2. PPG Industries.
3. Pilkington.

B. Equivalent products of other manufacturers will be evaluated as substitutions in accordance with requirements of Division 1.

2.2 FLAT GLASS MATERIALS

A. Flat Glass: ASTM C 1036 Type I (transparent glass, flat), Class 1 (clear), Quality Q3 (glazing select).

B. Mirror Glass: ASTM C 1036, Type I (transparent flat), Class 1 clear, Quality q2 mirror with silvering, copper coating and protective organic coating complying with FS DD-M-411.

1. Silvered Flat Glass Mirror: ASTM C 1503.

2.3 HEAT-TREATED FLAT GLASS MATERIALS

A. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.

B. Fabrication Process: By vertical (tong-held) or horizontal (roller-hearth) process, at manufacturer's option, except provide horizontal process where indicated as tongless or free of tong marks.

1. Fully Tempered Units: Contractor's Option, either provide fully tempered units that are heat soaked to eliminate spontaneous breakage from nickel sulfide inclusion or warrant fully tempered units without heat soaking.

C. Heat-Treated Flat Glass: ASTM C 1048, Kind HS (heat strengthened), Condition A (uncoated surfaces), Type I (transparent, flat), Class 1 (clear), Quality Q3 (glazing select).

D. Heat-Treated Flat Glass, Tempered Safety: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated surfaces), Type I (transparent, flat), Class 1 (clear), Quality Q3 (glazing select).

2.4 COATED GLASS MATERIALS

A. Pyrolytically Coated (Reflective) Glass Products: Flat Glass with solar-reflective metallic oxide coating applied pyrolytically during initial manufacture. Comply with ASTM C 1376.

1. Class: Class 1 (transparent).

B. Sputter-Coated, (Low-E) Glass: Flat Glass with metallic oxide or metallic nitride coating deposited by magnetic sputtering process after manufacture and heat treatment (if any). Comply with ASTM C 1376.

1. Class: Class 1 (transparent).

C. Ceramic-Coated Vision Glass: Flat Glass with ceramic coating applied by silk-screen process, ASTM C 1048, Condition C (other coated glass). Comply with GTA 95-1-31, "Specification for Decorative Architectural Flat Glass".

1. Class: Class 1 (transparent).

D. Ceramic-Coated Spandrel Glass: Flat Glass Kind HS (heat-strengthened Condition B (spandrel glass).

1. Class: Class 1 (transparent).

2. Fallout Resistance: Provide spandrel units identical to those passing fallout resistance test for spandrel glass specified in ASTM C 1048.

E. Back-Painted Glass: Flat Glass Kind HS heat-strengthened Condition B (spandrel glass).

1. Class: Class 1 (transparent).

2. Opacifying Coating: Water based silicone elastomer which is medium modulus, self-extinguishing, and non-corrosive by ICD Coatings. No substitutions.

a. Color: Custom Color to match Design Professional Sample.

2.5 SEALED INSULATING GLASS UNITS

A. General: Preassembled units consisting of sealed lights of glass separated by dehydrated air spaces complying with ASTM E 2190 units and with other requirements indicated.

1. For properties of individual glass lights making up units, refer to requirements specified elsewhere in this Section applicable to types, classes, kinds, and conditions of glass products comprising lights of insulating glass units.

B. Gas Filling: Fill air space with argon.

C. Sealing System: Dual seal, primary and secondary sealants: Manufacturer's standard sealants. .

D. Spacer: Aluminum with mill or clear-anodized finish, constructed with single joint.

1. Desiccant: Low nitrogen absorbing molecular sieve.

2. Corner Construction: Soldered or welded corner construction.

2.6 LAMINATED GLASS MATERIALS

A. General: Comply with ASTM C 1172 for kinds of laminated glass indicated and other requirements specified. Refer to primary and heat-treated glass requirements relating to properties of glass products comprising laminated glass products.

B. Kind of Laminated Glass per ASTM C 1172: Kind LA (two lights of annealed Type I glass). Kind LHS (two lights of heat-strengthened Type I glass.)

C. Interlayer: Interlayer material as indicated below, with a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after laminating glass lights and installation.

1. Interlayer Material: Polyvinyl butyl sheets.

2. Thickness: 0.030 inch minimum.

3. Products: Subject to compliance with requirements, provide one of the following:

a. Polyvinyl Butyral Interlayer: Saflex, by Solutia or Butacite, by E.I. du Pont de Nemours & Company, Inc.

1) Printed Pattern: Clear

D. Laminating Process: Fabricate laminated glass to produce glass free of foreign substances and air or glass pockets.

2.7 GLAZING MATERIALS

A. Use adhesives and sealants that comply with the VOC limits specified in Sustainability Requirements: Division 1.

B. Colors: Exposed sealant shall be selected by Design Professional from manufacturer's full range of standard colors.

C. Exposed Sealant: Silicone, neutral cure, low modulus:

1. Hardness (Shore A): 25 to 30.

2. Tensile Strength: Minimum 250 psi {1723 kPa}.

3. Dynamic Movement Capability: Minimum plus or minus 50 percent.

4. Comply with ASTM C 920, TT-S-01543 and TT-S-00230.

D. Concealed Sealant: Butyl or polyisobutylene, non-curing, non-skinning minimum 75 percent solid, comply with AAMA 809.2.

E. Glazing Tape: Preformed, nonstaining and nonmigrating in contact with nonporous surfaces, with spacer rod; as recommended in writing by tape and glass manufacturers for application indicated, and complying with ASTM C 1281 and AAMA 800 Series.

2.8 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of neoprene or EPDM complying with ASTM C 864 or silicone complying with ASTM C 1115, and of profile and hardness required to maintain watertight seal and to be compressed minimum 25 percent in final installation.

B. Soft Compression Gaskets: Extruded or molded closed-cell, neoprene, EPDM or silicone integral-skinned gaskets complying with ASTM C 509, Type II, black, and of profile and hardness required to maintain watertight seal. Glazing tape may be used for soft gaskets if approved in writing by manufacturer.

2.9 MISCELLANEUOS GLAZING ACCESSORIES

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials involved for glazing application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers and Sealers: Type recommended in writing by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore A durometer hardness of 85 plus or minus 5. Use silicone if required by any coating manufacturer.

D. Spacers: Elastomeric continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lights in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side-walking).

F. Plastic Foam Joint Fillers: Preformed, compressible, resilient, nonstaining, nonextruding, non-out-gassing, strips of closed-cell plastic foam of density, size, and shape to control sealant depth and otherwise contribute to produce optimum sealant performance.

G. Glazier Clips: Aluminum or stainless steel.

H. Mirror Support: Continuous stainless steel "J" shaped channel with No. 4 finish.

2.10 STRUCTURAL SILICONE GLAZING MATERIALS

A. General: ASTM C 1184, neutral cure, silicone sealant recommended in writing by manufacturer for intended use, compatible with insulated glazing seal. Manufacturer: Dow Corning, Momentive, Pecora, or Tremco. No substitutions.

B. Structural Glazing Sealant:

1. Minimum Tensile Strength: 100 psi {700 kPa}.
2. Color: Black, unless indicated otherwise.
3. Modulus of Elasticity: As required to not allow movement of more than 25 percent of joint width.

C. Weatherproofing Sealant:

1. Maximum hardness of 25 (Shore A).
2. Color: Black, unless indicated otherwise.

D. Spacer Tape: High density, open cell, non-staining foam tape recommended in writing by sealant manufacturer.

1. Minimum Density: 30 pcf {0.48 g/cubic m} per ASTM D 1667.
2. Minimum Hardness: 35 Shore A per ASTM D 2250.
3. Ultraviolet Resistance: 3000 hours per ASTM G 23.

E. Surface cleaner and primer as recommended in writing by sealant manufacturer.

F. Products: All products shall comprise highest quality structural glazing system recommended by glazing manufacturer.

2.11 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

A. Fabricate glass and other glazing products in sizes required to glaze openings indicated, with edge and face clearances, edge and surface conditions, and bite complying with written recommendations of product manufacturer and referenced glazing standard as required to comply with system performance requirements.

B. Clean cut or flat grind vertical edges of butt-glazed monolithic lights in a manner that produces square edges with slight kerfs at junctions with indoor and outdoor faces.

C. Grind and polish mirror edges. Cut out for penetrations through mirror.

D. Shop fabricate glazing gaskets for each opening by welding all joints to produce a single piece, full perimeter assembly with no field joints required.

1. Pressure plate gaskets do not need to be shop fabricated.

2.12 SOURCE QUALITY CONTROL

A. Fabrication Tolerance: Comply with requirements of ASTM C 1036 and C 1048.

B. Inspection and Testing: Comply with Exterior Enclosure, General: Division 7.

Part 3 EXECUTION

3.1 EXAMINATION

A. Project Site Verification: Examine glass framing, with all interested parties present, for compliance with the following:

1. Published manufacturing and installation tolerances, including those for size, squareness, offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face or edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Do not proceed with glazing until unsatisfactory conditions have been corrected.

C. Commencing glazing constitutes acceptance of glass framing members.

3.2 GLAZING: GENERAL

A. Comply with combined written recommendations of manufacturers of glass, sealants, gaskets, and other glazing materials, except where more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass from edge damage during handling and installation as follows:

1. Use a rolling block in rotating glass units to prevent damage to glass corners. Do not impact glass with metal framing. Use suction cups to shift glass units within openings. Do not raise or drift glass with a pry bar. Rotate glass lights with flares or bevels on bottom horizontal edges so edges are located at top of opening, unless otherwise indicated, by manufacturer's label.
2. Remove damaged glass from Project Site and legally dispose of off Project Site. Damaged glass is glass with edge damage or other imperfections, that, when installed, weaken glass and impair performance and appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing. Primers are always required at structural silicone glazing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing standard, unless otherwise required, by glass manufacturer. Set blocks in thin course of compatible sealant.

E. Do not exceed edge pressures recommended in writing by glass manufacturers for installing glass lights.

F. Provide spacers for glass sizes as follows:

1. Locate spacers continuously inside, and outside, and directly opposite each other. Install correct size to preserve required face clearances.

2. Where gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and comply with system performance requirements, separate spacers are not required.

G. Provide edge blocking to comply with requirements of referenced glazing publications, unless otherwise required in writing by glass manufacturer.

H. Set glass lights in each series with uniform pattern, draw, bow, and similar characteristics.

I. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subject to movement.

J. Square cut overlength at corners and install gaskets in manner recommended in writing by gasket manufacturer to prevent corners from pulling away; seal corner joints with sealant recommended in writing by gasket manufacturer.

3.3 EXTERIOR EXPOSURE - DRY PRESSURE PLATE METHOD

A. Cut glazing gasket to length; install on fixed stop. Seal corners.

B. Install shop fabricated, one-piece glazing gasket on fixed stop.

C. Place setting blocks and edge blocks.

D. Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.

E. Install removable stops complete with glazing gaskets. Exert pressure for full continuous contact.

F. Trim protruding edge.

G. Use typically for all Curtainwall work, where indicated.

3.4 EXTERIOR EXPOSURE - DRY METHOD (WEDGE GASKET)

A. Cut glazing gasket to length; install on fixed stop. Seal corners.

B. Install shop-fabricated, one-piece glazing gasket on fixed stop.

C. Place setting blocks and edge blocks.

D. Hold glazing slightly above setting blocks and push against fixed stop with sufficient pressure to attain full contact.

E. Dense wedge gaskets, cut slightly long for opening. Install wedge at sill first, let glazing down on to setting blocks and complete wedge gasket on remaining three sides.

F. Trim protruding tape edge.

G. Use typically for Storefront work, unless otherwise indicated.

3.5 INTERIOR EXPOSURE - WET METHOD (SEALANT AND SEALANT)

A. Place setting blocks and edge blocks and install glazing pane or unit.

B. Install removable stops with glazing centered in space by inserting continuous spacer shims both sides at 1/4 inch below sight line.

C. Fill gaps between glazing and stops with sealant to depth of bite on glazing, but not more than 3/8 inch below sight line to ensure full contact with glazing and continue air and vapor seal.

D. Apply sealant to uniform line, flush with sight line. Tool or wipe sealant surface smooth. Tool horizontal joints to form a wash.

E. Use typically for side lites and frameless glazing work, unless otherwise indicated.

3.6 STRUCTURAL SILICONE GLAZING

A. General: Comply with manufacturer's written instructions.

B. Shop Fabrication: Four-sided structural silicone glazing shall be completed in shop. Glass shall be glazed onto metal subframes for mechanical attachment in field.

C. Preparation: Clean surface by pouring solvent onto a clean rag, wiping vigorously and immediately wiping excess solvent away with a second clean rag.

D. Priming: Prime surface of metal using a thin film adhesion promoter.

E. Install spacer tape on metal frame.

F. Apply structural silicone and push glazing into sealant to provide continuous contact. Tool joint smooth and straight. Temporarily support glass until sealant sets up.

G. After glass and subframe units have been installed in field, install backer and weathering sealant, tool joint.

H. Use typically for Curtainwall and Storefront butt glazing work, unless otherwise indicated.

3.7 INSTALLATION – MIRRORS AND ACCENT GLASS

A. Set continuous bottom channel. Anchor rigidly to wall construction.

B. If recommended by adhesive manufacturer, apply primer to wall prior to setting glass.

C. Set glass with adhesive, applied in accordance with adhesive manufacturer's written instructions.

.

3.8 FIELD QUALITY CONTROL

A. Comply with requirements of Exterior Enclosure, General: Division 7.

B. Monitor and report installation procedures, unacceptable conditions and substrates to Contractor prior to proceeding.

C. Do not cover Work which is to be inspected or tested until directed.

3.9 CLEANING

A. Clean Work under provisions of Division 1.

B. Remove glazing materials from finish surfaces.

C. Remove non-permanent labels after Work is complete.

D. Clean glass and mirrors.

E. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.10 PROTECTION OF FINISHED WORK

A. After installation, mark pane with an "X" by using removable plastic tape or streamers attached to framing and held away from glass. Do not attach markers to glass.

B. Protect glass from contact with contaminating substances resulting from construction operations including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately in accordance with written recommendations by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than, once a month, for build-up of dirt, scum, alkali deposits, or stains, and remove in accordance with written recommendations by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents and vandalism, during Construction Period.

3.11 SCHEDULE

A. General:

1. Glass Types indicated in Schedule shall comply with indicated requirements.

2. Whether indicated in Schedule or not, provide heat-treated glass, Kind HS, heat strengthened, where required to comply with system performance criteria. Provide Kind FT, fully-tempered, only where safety glass is designated or required.

B. Single Pane Glass Unit: Glass Type GL-1: Clear Flat Glass, fully tempered, min. 1/2 inch thick (Interior doors and windows).

C. Laminated Glass Unit: Glass Type GL-2: White interlayer, inner and outer light low iron flat glass heat strengthened, ¼" thick. (Dance studio marker boards).

D. Single Pane Glass Unit: Glass Type GL-M: Mirror Glass.

E. Insulating Glass Unit: Glass Type IGU-1 (Vision):

1. Classification: ASTM E 2190.

2. Outer Light: Low iron glass with VRE31-43 coating by Viracon and bird friendly ceramic coated frit pattern on #2 surface. (Frit pattern and color to be selected from mfr's standard patterns)

3. Inner light: Low iron glass.

4. Visible Light Transmittance: Minimum 46 percent.

5. Summer Daytime U-value: Maximum 0.26.

6. Winter Nighttime U-value: Maximum 0.29.

7. Solar Heat Gain Coefficient: Maximum 0.22.

8. Shading Coefficient: Minimum 0.25.

9. Provide Heat Treated Flat Glass as recommended by manufacturer for thermal stresses.

F. Insulating Glass Unit: Glass Type IGU-2 (Laminated).

1. Classification: ASTM E 2190.

2. Outer Light: Same as IGU-1
3. Inner Light: Two layers ¼" low iron flat glass w/ PVB laminated interlayer.

G. Insulating Glass Unit: Glass Type IGU-3 (Tempered Safety Glass)

1. Classification: ASTM E 2190.
2. Outer Light: Same as IGU-1
3. Inner Light: Same as IGU-1
4. Provide Tempered Safety Flat Glass.

H. Insulating Glass Unit: Glass Type IGU-4 (Shadow Box):

1. Classification: ASTM E 2190.
2. Outer Light: Same as IGU-1
3. Inner light: Same as IGU-1
4. Provide Shadow Box assembly as indicated on drawings.

END OF SECTION 088000

SECTION 092900 GYPSUM WALLBOARD ASSEMBLIES

Part 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Applicable Sections: Division 1.

C. Cold-Formed Metal Framing (CFMF): Division 5.

D. Rough Carpentry: Division 6.

E. Sheathing: Division 6.

F. Air/Vapor Barriers: Division 7.

G. Building Insulation: Division 7.

H. Firestopping: Division 7.

I. Joint Sealants: Division 7.

J. Access Doors: Division 8.

K. Gypsum Shaftwall Assemblies: Division 9.

L. Tile: Division 9.

1.2 SUMMARY (NON-INCLUSIVE)

A. Section Includes:

1. Gypsum wallboard for partitions, ceiling, and exterior soffits.
2. Nonload-bearing (axial) steel framing.
3. Acoustical insulation and sealants for gypsum wallboard.
4. Cement board.
5. Water-resistant gypsum panels.

1.3 SUBMITTALS

A. Submit for Record only.

B. Product Data: For each material, anchor and accessory and miscellaneous product. Show provisions for conformance with indicated criteria.

C. Certifications: Certificates showing components and assembly required to comply with indicated fire-resistance. Show name of Testing Agency and test number. Substantiate required STC rating for each gypsum wall assembly.

D. Sustainability Submittals: Provide the following in accordance with Sustainability Requirements: Division 1.

1. Materials Sustainability Documentation Form.

2. Product data, certification letter, and costs for materials with recycled content.
3. Product data and costs for regional materials.
4. Product data for adhesives and sealants indicating VOC content.

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1.4 SYSTEM DESCRIPTION

A. General: Select gypsum partition systems from manufacturers' published standard assemblies that comply with requirements indicated. All components of system by one (1) manufacturer.

1.5 TERMINOLOGY

A. Term "gypsum wallboard" is generic, and as such refers to preformed board type materials specified in this Section. Provide product specified for its indicated use.

1.6 QUALITY ASSURANCE

A. Referenced Codes and Standards: Comply with the following in accordance with Division 1.

1. Gypsum Association Publications (GA)

201	Using Gypsum Board for Walls and Ceilings
216	Application and Finishing of Gypsum Board
214	Levels of Gypsum Board Finish
226	Application of Gypsum Board to Curved Surfaces
505	Gypsum Board Terminology
600	Fire Resistance Design Manual

B. Formaldehyde and VOC classification, as tested per ASTM D 5116 and according to standards established by the Collaboration for High-Performance Schools (CHPS), the California Office of Environmental Health Hazard Assessment (OEHHA), and the USGBC LEED of Schools.

1. Products are classified as zero-or-low emitting for formaldehyde and VOC emission as defined:
   a. "Zero-Emitting":
      1) Materials producing concentration levels below the test-chamber background level specified by the "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addendum. Section 3.8.4.3 states, "Background concentrations in the empty chamber ventilated at 1.0 air changes per hour shall not exceed 2ug m-3 (1.6 ppb) for any individual VOC, including formaldehyde" and all VOCs with chronic inhalation Reference Exposure Levels adopted by California EPA COEHHA for Proposition 65 chemicals.
   b. "Low-Emitting":
      1) Materials passing CHPS requirements as established in the "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, "including 2004 Addendum. In addition, these products produce formaldehyde concentration levels below 16.5 ug m-3 (13.5 ppb) and contribute no more than one-half of the chronic inhalation Reference Exposure Level adopted by California EPA COEHHA for all other VOCs identified by Proposition 65.
2. Must be tested by independent lab per these standards along with product submittals.

a. Documentation of laboratory test must indicate products and item number if test results differ for other facility manufacturing location for supplied products.

3. Acceptable products must be listed on the Collaborative for High-Performance Schools (CHPS) website found at http://www.chps.net/manual/lem_table.htm.

4. If only select item numbers within a product family or products formulated in select manufacturing facilities meet the CHPS requirements and are listed on the CHP website, product literature and samples must clearly indicate that the product meets either zero-or low-emitting standards per the CHPS test protocol. In instances where only selected items from a manufacturer meet the CHPS protocol, product packaging or labeling must clearly indicate the product meets the minimum requirements of the CHPS test standard for zero- or low-emitting products.

C. Regulatory Requirements: Components of fire rated assembly shall comply with a listed assembly of required fire rating of Underwriters Laboratories, Inc. or other independent Testing Agency approved by Building Code Official having jurisdiction.

D. Seismic Requirements: Comply with applicable State and Local Seismic Code requirements.

1.7 DELIVERY, HANDLING AND STORAGE

A. Package or palletize rigid board materials to avoid permanent deflection and damaged edges.

B. Store materials in a dry location, out of weather. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

C. Store water-based joint finishing materials and adhesives at temperatures above freezing and within range specified in writing by manufacturer.

1.8 FIELD CONDITIONS

A. Environmental Requirements: Maintain environmental conditions in compliance with ASTM C 840 and manufacturer's written recommendation.

B. Maintain temperatures between 50 degrees F and 95 degrees F for 48 hours prior to application and continuously until dry.

C. Ventilate spaces to eliminate excessive moisture from building during and after period of gypsum wallboard installation.

D. When gypsum wallboard is erected prior to completion of weather tight enclosure and compliance with requirements above, provide paperless, glass mat faced, water resistant gypsum core wallboard.

E. Do not install panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

Part 2 PRODUCTS

2.1 GENERAL

A. Provide recycled content materials in accordance with Sustainability Action Plan specified in Sustainability Requirements: Division 1 and as indicated below.

B. Provide regional materials in accordance with Sustainability Action Plan specified in Sustainability Requirements: Division 1and as indicated below.

C. Use adhesives and sealants that comply with the VOC limits specified in Sustainability Requirements: Division 1.

2.2 STEEL FRAMING COMPONENTS

A. Component Sizes and Spacings:

1. Provide framing components of minimum sizes indicated. If sizes indicated do not conform to required conditions, provide components sized and spaced in accordance with criteria indicated.

2. At Contractor's option, in lieu of minimum sizes indicated, provide components as required to comply with the following criteria.

   a. Walls and Partitions: Size and space components as required for a maximum deflection of L/240 under a 5 psf uniform lateral load per ASTM C 754.
   b. Ceilings and Soffits: Size and space components as required for a maximum deflection of L/240 under twice dead load plus a 10 psf live load per ASTM C 754.
   c. Engineering: Select components from manufacturer's pre-printed span tables or provide calculations signed and sealed by a Professional Engineer licensed in the Commonwealth of Kentucky.

B. Finishes:

1. Interior Exposures: Manufacturer's standard corrosion resistant coating.

2. Components in Exterior Walls and Soffits: G40 hot-dipped galvanized per ASTM A653/A653M.

C. Studs and Runners: ASTM C 645, with flange edges of studs bent back 90 degrees and doubled over to form [3/16 inch] {5 mm} wide minimum return lip, depth as indicated.

1. Minimum Thickness of Uncoated Base Metal: 0.0179 inch/25 gage except where heavier gages are indicated. At cement board provide 0.0329 inch/20 gage, 16 inches on centers.

   a. 0.0270 inch/22 gage at Level One Lobby and public Corridors partitions.

2. Maximum stud height, as follows:

	Stud Spacing inches	**Stud Width inches**	**Maximum Stud Height feet-inches**
a.	16	2 1/2	11-6
b.	16	3 5/8	15-0
c.	16	4	16-0
d.	16	6	18-0
e.	24	2 1/2	10-6
f.	24	3 5/8	13-6
g.	24	4	14-6
h.	24	6	16-0

a. Notes for stud height tables:

1) Studs must have gypsum wallboard on both sides full height or unsupported flanges shall be braced as indicated.

2) Studs rigidly braced at or below maximum height may be increased 50 percent in height.

3) Bracing: Suspended gypsum wallboard or plaster ceiling or separate bracing as required for the top of partitions that do not extend to structure.

3. Fire rated partitions shall comply with indicated requirements for each fire-rated assembly which may exceed stud gage, width, and spacing in tables.

D. Rigid Furring Channels: ASTM C 645, hat-shaped.

1. Depth: 7/8 inch.

2. Thickness of Uncoated Metal: 0.0179 inch/25 gage , unless otherwise indicated.

E. Furring Brackets: Serrated-arm type, adjustable, complying with ASTM C 645, minimum thickness of base (uncoated) metal of [0.0329 inch/20 gage] {0.83 mm}, designed for screw attachment to steel studs and steel rigid furring channels used for furring.

F. Channels: Cold-rolled steel, [0.055 inch] {1.4 mm} minimum thickness of base (uncoated) metal and [1/2 inch] {13 mm} wide flanges.

1. For Suspended Ceilings: 1 1/2 inches] deep.

2. For Bridging and Furring: 3/4 inch deep.

G. Grid Suspension System for Interior Ceilings: ASTM C 645, manufacturer's standard direct-hung grid suspension system composed of main beams and cross furring members that interlock to form a modular supporting network.

H. Miscellaneous Metal Framing Components: Match material and finish of studs.

1. Framing and Reinforcing Angles: 2 inch by 2 inch, minimum 0.0329 inch/20 gage.

2. Plates and Strapping: Sizes as indicated and required.

2.3 STEEL FRAMING ACCESSORIES

A. Screws: Corrosion-resistant coated steel drill screws.

1. For steel less than 0.03 inch: ASTM C 1002.

2. For steel over 0.03 incH: ASTM C 954.

B. Anchors in Concrete: Cast-in-place, chemical or expansion type anchors fabricated from corrosion-resistant materials. For anchors suspending ceilings, select based on load capacity of six (6) times-imposed load determined per ASTM E 488.

C. Powder-Actuated Fasteners: Corrosion-resistant fastener plus clip or washer as required to suit application. For fasteners suspending ceilings, select based on load capacity of ten (10) times-imposed load determined per ASTM E 1190.

D. Wire for Hanger and Ties: ASTM A 641, Class 1 zinc coating, soft-temper, minimum 8 gage {4.2 mm} for hangers and 16 gage {1.6 mm} for ties.

2.4 WALLBOARD PANELS

A. General: 5/8-inch-thick by longest possible lengths; long edges tapered, ends square cut. Refer to installation instruction for use of each type.

1. Recycled Content Gypsum Board: Minimum 25 percent total recycled content, including recovered "flue gas" gypsum and post-consumer scrap paper and gypsum.

2. Synthetic Gypsum Board: 75 percent post-industrial recycled content, fabricated from synthetic gypsum and recycled paper facings.

3. Facing Paper for Gypsum Board: 100 percent recycled newsprint.

B. Flexible Gypsum Board: ASTM C 1396/C 1396M. Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.

1. Thickness: 1/4 inch

2. Long Edges: Tapered.

C. Gypsum Wallboard, Contractor's Option: Select appropriate type of wallboard based on level of protection for environmental conditions.

1. Weather Exposure: Where installation of gypsum wallboard occurs before completion of exterior enclosure or temporary protection is not in place to protect gypsum wallboard from moisture, provide paperless gypsum wallboard panels with water resistant treated cores, complying with ASTM C 1177 or C 1178 and C 630, score of 10 when tested according to ASTM D 3273, in lieu of standard or fire-rated wallboard listed below.

a. Product:

1) DensArmor Plus by Georgia Pacific.

2) Fiberock Aqua-Tough Panels by USG.

3) Approved Equivalent.

b. Fire-resistive type, UL rated when indicated for rated assemblies.

2. Protected: Where environmental conditions are maintained in accordance with Article 1, provide standard gypsum wallboard complying with ASTM C 1396. Fire-resistive type, UL rated when indicated for rated assemblies.

D. Moisture Resistant Gypsum Wallboard: Paperless gypsum wallboard panels with water resistant treated cores, complying with ASTM C 1177 or C 1178 and C 630, score of 10 when tested according to ASTM D 3273.

1. Product:

   a. DensArmor Plus by Georgia Pacific.
   b. Fiberock Aqua-Tough Panels by USG.
   c. Approved Equivalent.

2. Fire-resistive type, UL rated when indicated for rated assemblies.

E. Cement Board (Tile Backer Board): Contractor's Option: Select from products listed, select appropriate type and coordinate other components at fire rated assemblies requiring cement board. [1/2 inch] {13 mm} thick except use [5/8 inch] {16 mm} portland cement board or paperless gypsum wallboard where required to match adjacent panels.

1. Portland Cement Board: ANSI A118.9. Durock Brand Cement Boards by USG.

2. Paperless gypsum wallboard panels, water resistant coating and with water resistant treated cores, complying with ASTM C 1178.

   a. Product:

      1) DensShield Tile Backer by Georgia Pacific.

      2) Fiberock Tile Backerboard by USG.

   b. Fire-resistive type, UL rated when indicated for rated assemblies.

2.5 TRIM ACCESSORIES

A. Standard Trim: Comply with ASTM C 1047 zinc-coated steel with perforated or expanded wings or flanges of the type to be concealed with joint finishing material. Profiles to match Gypsum Association types:

1. Cornerbead: CB Series.

2. Edge Trim: "LC" Bead.

3. Control Joint: V-shaped slot with removable paper strip.

B. Contractor's Option, Standard Trim Optional Paper Faced Metal Bead and Trim: Comply with applicable standards. Units with perforated or expanded wings or flanges of type to be concealed with joint finishing material. Profiles to match Gypsum Association types: Cornerbead: CB Series, Edge Trim: "LC" Bead and Control Joint: V-shaped slot with removable paper strip.

1. Paper faced metal bead and trim shall meet or exceed FS qq-s-775-d, Type 1, Class E ASTM C 1047.

2. Products:

   a. Beadex Manufacturing Co., Inc.
   b. United States Gypsum Company.

C. Special Trim Accessories: pre-primed extruded aluminum trim of special shapes.

1. Manufacturers:

   a. Fry Reglet.
   b. Gordon, Inc.
   c. M & M Systems, Inc.
   d. Pittcon Industries, Inc.
   e. Equivalent products of other manufacturers will be evaluated as substitutions in accordance with requirements of Division 1.

2. Profiles:

   a. Reveal: Series 300 by Gordon, size and configuration as indicated.
   b. Reveal at Ceiling: Series 985 by Gordon, 1/2 inch by 1 inch.

3. Fabrication: Factory prefabricate intersections of special trim to allow for butt joints only in field.

2.6 JOINT TREATMENT MATERIALS

A. Compounds: Comply with ASTM C 475/C475M and as recommended in writing gypsum wallboard manufacturer, drying or setting type as indicated.

B. Joint Tape for Gypsum Wallboard: Paper reinforcing tape.

C. Joint Tape for Cement Wallboard: Glass-fiber mesh tape recommended in writing by gypsum wallboard manufacturer.

D. Cement Wallboard Mortar: ANSI A 118.1, dry set mortar or ANSI A 118.4, latex-modified mortar.

2.7 ACOUSTICAL MATERIALS

A. Acoustical Sealant: Refer to Joint Sealants: Division 7.

B. Sound Attenuation Blankets: ASTM C 665, Type I, Fibers manufactured from slag.

C. Compressible Filler: Sound Attenuation Blankets or if required to support acoustic sealant, provide compressible foam backer material compatible with the acoustic sealant.

2.8 MISCELLANEOUS MATERIALS

A. Fastening Adhesive: As recommended in writing by panel manufacturer for laminating gypsum wallboard panel to appropriate substrate.

B. Sound-Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

Part 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates to which gypsum wallboard assemblies attach or abut, installed hollow metal frames, cast-in-anchors, and structural framing for compliance with installation tolerances and other conditions affecting performance of assemblies indicated.

B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Ceiling Anchorages: Coordinate installation of ceiling suspension systems with installation of overhead structural assemblies to ensure that inserts and other provisions for anchorages to building structure have been properly installed.

B. Furnish concrete inserts and other devices indicated to Work specified in other Sections for installation well in advance of time needed for coordination with other construction.

C. Before Sprayed Fire-Resistive Material is applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive Sprayed Fire-Resistive Material. Where offset anchor plates are required, provide continuous units fastened to building structure not more than 24 inches on center.

D. After Sprayed Fire-Resistive Material has been applied, remove only as much Sprayed Fire-Resistive Material as required to complete installation of gypsum wallboard assemblies without reducing thickness of Sprayed Fire-Resistive Material below that is required to obtain fire-resistive rating indicated. Protect remaining Sprayed Fire-Resistive Material from damage.

E. At partitions parallel to flutes of metal deck, fill affected flutes with mineral wool and cover with flat plate attached at each edge minimum 24 inches on center

3.3 INSTALLATION: STEEL FRAMING: GENERAL

A. Installation Standards: Comply with indicated requirements and with ASTM C 754.

1. Contractor may provide alternate systems described in ASTM C 754 in lieu of requirements if approved by Design Professional.

2. Contractor may elect to pre-fabricate wall assemblies in panels for field installation and finishing.

B. Isolate steel framing from building structure to attain lateral support and prevent axial loading. Provide slip or cushioned type joints. Comply with details indicated and with manufacturer's written instructions.

C. Do not bridge building expansion and control joints with steel framing or furring members. Independently frame both sides of joints.

D. Install supplementary framing and bracing at terminations in gypsum wallboard construction. Install plates, angles or miscellaneous framing to support gypsum wallboard.

3.4 INSTALLING STEEL FRAMING FOR SUSPENDED AND FURRED CEILINGS

A. Suspend ceiling hangers from building structural members and as follows:

1. Install hangers sloped not more than 1 in 6 from plumb and free from contact with objects that are not part of supporting structural or ceiling suspension system. Splay hangers beyond 1 in 6 only where required to avoid obstructions and offset resulting horizontal forces by bracing, counter-splaying, or other equally effective means.

2. Where obstructions interfere with the location of hangers, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers per referenced standards.

3. Secure wire hangers by looping and wire-tying, directly to structure, inserts or anchors

4. Do not attach hangers to steel roof deck.

5. Do not connect or suspend steel framing from ducts, pipes or conduit or their supports.

B. Install suspended steel framing as follows (Contractor's Option):

1. Runners and Furring:

a. Wire Hangers: 4 feet on center.
b. Carrying Channels (Main Runners): 4 feet on center.
c. Rigid Furring Channels (Furring Members): 16 incheson center.
d. Wire-tie or clip furring members to main runners and to other structural supports as indicated.

2. Grid Suspension System: Attach perimeter wall track or angle where grid suspension system meets vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

3. Metal Studs:

a. Fasten runner track to perimeter construction.
b. Install studs 24 inches on center with webs vertical and both flanges fastened to runner.

1) 1 5/8-inch stud: 5 foot maximum span.

2) 2 1/2-inch stud: 6 foot maximum span.

3) 3 5/8-inch stud: 8 foot maximum span.

c. Provide 2 inch cold rolled channels with 1 inch by 3/16-inch mild steel flat hanger at 3 feet on center for studs beyond indicated span.

C. Sway brace framing at maximum 10 feet on center each direction with pairs of in-line wire ties sloped at approximately 45 degrees. Alternating pairs of ties shall be perpendicular to each other.

D. Reduce spacing of framing members for attachment of moisture resistant boards, cement board and other panels within span limits recommended by manufacturer.

3.5 INSTALLING STEEL FRAMING FOR WALLS AND PARTITIONS

A. Provide framing of widths indicated to coordinate with hollow metal work.

B. Install runners (track) at floors, ceilings, structural walls, columns and where gypsum wallboard stud assemblies abut other construction. Anchor runners within 2 inches of each end and at maximum 24 inches on center.

1. At fire resistive rated partitions, install single deep-leg deflection tracks and anchor to building structure, or install double deep-leg deflection tracks and anchor outer track to building structure.

C. Install studs 16 inches on center or 24 inches on center, except 16 inches on center at cement board.

D. Extend partition framing full height to structural supports or substrates above, unless otherwise indicated.

1. Cut studs1/2 inch short of full height and friction fit only at head.

2. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum wallboard.

3. For fire resistive rated partitions and partitions indicated to have full gypsum wallboard coverage above suspended ceiling, install framing around structural and other members extending below floor/roof decks, as provided, to support continuous gypsum wallboard closures.

4. At fire resistive rated partitions with Single Deflection Track, install row of horizontal bridging within 2 inches of single deflection track (for perimeter attachment of panel).

E. Terminate partition framing at suspended ceiling where indicated and brace to structure.

F. Terminate partition framing above suspended ceilings where indicated and brace to structure.

G. Bracing: Brace top of partitions that do not extend to structure as follows:

1. Brace shall be studs matching partition, sloped at 40 to 50 degrees and oriented within 10 degrees of perpendicular to partition.
2. Anchor brace to structural members or to concrete floor or roof slab with minimum two (2) explosive set nails or No. 8 self-drilling screws.
3. Locate anchors at each unsupported end and at maximum 4 feet on center along each unsupported length of partitions. Tee and cross intersections may be used as a brace if legs of intersecting partition are minimum of 3 feet long.
4. Where partitions support furniture, shelving or other wall mounted elements over 10 pounds per lineal foot increase spacing of bracing to match stud spacing of partition.
5. Brace partitions at door and other openings as described below:
    a. Frame door openings to comply with GA-219. Provide double 20 gage studs at both jambs. Provide 20 gage runner track section, for cripple studs, at head and secure to jamb studs.
    b. Extend jamb studs through suspended ceilings and attach to structure above or provide diagonally stud bracing to structure at each jamb as described for bracing above.
    c. Frame openings other than door openings in same manner as required for door openings. Install framing below sills of openings to match framing required above door heads.

H. Curved Partitions:

1. Cut top and bottom runners through leg and web at 2-inch intervals for arc length. Allow for uncut straight ends of not less than 12 inches.
2. Bend runners to uniform curve of radius indicated and locate straight lengths so they are tangent to arcs.
3. Support outside (cut) leg of runners by fastening a 1 inch high by 0.0209 inch 25 gage thick sheet steel strip.
4. At Contractor's option provide runners roll formed to required radius.
5. Begin and end each arc with studs on straight lengths at[6 inches on center. Space studs along arc as follows:
    a. Maximum inside radius of 2 feet 6 inches: Studs maximum 6 inches on center.
    b. Maximum inside radius of 3 feet 6 inches: Studs maximum 8 inches on center.
    c. Maximum inside radius of 4 feet 6 inches: Studs maximum 12 inches on center.
    d. Inside radius over 4 feet 6 inches: Studs 16 inches on center.

3.6 INSTALLATION OF SUPPLEMENTARY STRAPPING, BLOCKING AND BRACING

A. Brace each face of studs not covered with gypsum wallboard or other panels at maximum 8 inches from unsupported ends and 4 feet on center including studs used in soffit and ceiling assemblies.

1. At chase walls brace between walls with studs or 12-inch-wide scraps of gypsum wallboard
2. At other locations provide 1-inch strapping.

B. Provide support for each door stop, wall-mounted hook and other light- weight element with notched runner track, 3/4-inch plywood or with minimum 4-inch-wide by 25 gage strap.

C. Provide support for wall-hung shelves, cabinets, handrail brackets and all other elements hung from or attached to wall with 2 inch by 6 inch pressure treated wood blocking, continuous 6 inch by 16 gage flat strapping or continuous 6 inch by 20 gage runner channel, notched at each stud.

D. Provide support at joint between cement board and gypsum wallboard with continuous 4 inch by 25 gage strap or 25 gagerunner notched at each stud.

3.7 ERECTION TOLERANCES FOR STEEL FRAMING

A. Limit variations from plumb, level or dimensioned angle to the following:

1. 1/8-inch maximum deviation in any 10 feet vertical, angular, or horizontal runs, non-cumulative.
2. 1/4-inch maximum deviation in any 40 foot run, any direction, non-cumulative.

B. Limit variations from location (theoretical calculated positions in plan or elevation based on established floor lines and column lines), including variations from plumb and level, to the following:

1. 1/4 inch total maximum deviation for any element at any location, non-cumulative.
2. 1/8-inch maximum change in deviation for any element for any 10 foot run, any direction, non-cumulative.

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3.8 GYPSUM WALLBOARD INSTALLATION

A. Application Standards: Comply with ASTM C 840 and GA-216.

B. Panel Types and Usage:

1. Standard Gypsum Wallboard: Provide unless otherwise indicated.
2. Fire-Rated Gypsum Wallboard: Provide in fire rated assemblies.
3. Cement Board: At toilet rooms behind all tiled surfaces, provide cement board to comply with ANSI A108.11. Provide water resistant membrane of double layer 30 lb building paper or other membrane compliant with Tile Council of America behind Portland Cement Board and Wood Fiber Cement Board as recommended by manufacturer. Tape and fill joints with setting type compound.
4. Moisture Resistant Gypsum Wallboard, Fire-Rated Where Required: Walls and ceilings at (Contractor's Option) Toilet Rooms where thin set ceramic tile is indicated in place of Cement Board, and Janitor's closets. Exterior Soffits, as indicated.

C. Sound Attenuation Blankets: Provide where indicated prior to installing gypsum wallboard panels unless blankets are readily installed after gypsum wallboard panels have been installed on one (1) side. Completely fill wall cavity by cutting oversize and stuffing full. Support with clips or adhesive.

D. Ceiling Panels: Minimize the number of abutting end joints and avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent gypsum wallboard panels not less than one (1) framing member.

E. Wall/Partition Panels: Minimize number of abutting end joints or avoid them entirely. Stagger abutting end joints not less than one (1) framing member in alternate courses of gypsum wallboard.

F. Install gypsum wallboard panels with face side out. Do not install imperfect, damaged, or damp gypsum wallboard panels. Butt gypsum wallboard panels together for a light contact at edges and ends with not more than 1/16 inch of open space between gypsum wallboard panels. Do not force into place.

G. Locate both end joints over supports.

H. Position adjoining gypsum wallboard panels so that tapered edges abut tapered edges, and field-cut edges abut field-cut edges and ends. Do not place tapered edges against cut edges or ends.

I. Stagger vertical joints over different studs on opposite sides of partitions.

J. Do not place joints at corners of framed openings.

K. Unless otherwise indicated, cover both faces of steel stud partition framing with gypsum wallboard panels in concealed spaces, including spaces above ceilings, except in chase walls that are braced internally.

1. Fit gypsum wallboard panels around ducts, pipes, and conduits. Allow 1/4 inch to 1/2 inch wide joints to install appropriate sealant.

2. At head of fire-rated partitions abutting metal deck, provide gypsum wallboard as required to comply with fire stopping system.

3. At head of non fire-rated partitions abutting metal deck, provide an additional strip of gypsum wallboard approximately 12 inches wide on one side of partition, with top edge cut to follow the profile of the deck. Attach strip to studs to not interfere with slip head connection. Allow 1/4 inch to 1/2 inch wide joints to install appropriate sealant.

4. Where partitions intersect open structural members projecting below underside of floor/roof slabs and decks, cut gypsum wallboard panels to fit profile formed by structural members; allow 1/4 inch to 1/2-inch-wide joints to install appropriate sealant.

L. Space fasteners in gypsum wallboard panels according to referenced gypsum wallboard application and finishing standard and manufacturer's written recommendations.

M. Do not fasten into top track at head conditions designed to accommodate deflection or movement or at other similarly conditions.

N. At penetrations over 16 square inches, including electrical panels, recessed boxes, fire extinguisher cabinets and in one (1) face of fire-rate assemblies, maintain rating of assembly by installing additional layers of gypsum wallboard behind penetrating element. Additional layers behind cement shall match the layers cut out of penetration.

O. Single-Layer Application:

1. Ceilings: Apply gypsum wallboard panels prior to wall/partition panels at right angles to framing, unless otherwise indicated.

2. Partitions/Walls: Apply gypsum wallboard panels vertically or horizontally, unless parallel application is required for fire-resistive rated assemblies.

3. Z-Furring Members: Apply gypsum wallboard panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.

P. Double-Layer Application: Install gypsum wallboard backing for base layers and gypsum wallboard for face layers.

1. Ceilings: Apply base layer prior to applying base layer on walls/partitions; apply face layers in same sequence. Offset face-layer joints at least 10 inches from parallel base-layer joints. Apply base layers at right angles to framing members, unless otherwise indicated.

2. Partitions/Walls: Apply base layers and face layers vertically, parallel to framing, with joints of base layers located over stud or furring member and face layer joints offset at least one (1) stud or furring member with base layer joints. Stagger joints on opposite sides of partitions.

3. Z-Furring Members: Apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one (1) furring member. Locate edge joints of base layer over furring members.

Q. Curved Partitions:

1. Use longest lengths of gypsum wallboard panels possible to avoid joints in curved area.

2. Wet gypsum wallboard panels as per Gypsum Associations published recommendations.

3. Apply gypsum wallboard panels horizontally. Fasten panels to framing with screws spaced 12 inches on center.

4. For double-layer construction, apply gypsum wallboard base layer horizontally and fasten to studs with screws spaced 16 inches on center. Center gypsum wallboard face layers over joints in base layer and fasten to studs with screws spaced 12 inches on center.

5. Allow wetted gypsum wallboard panels to dry before applying joint treatment.

3.9 TRIM INSTALLATION

A. Place control joints to be consistent with lines of building spaces and in consistent pattern.

1. General: Where indicated, install as indicated, but not less than spacing criteria herein specified.
2. Install control joints in ceilings exceeding 2500 square feet in area and in partition, wall and wall furring runs exceeding 30 feet, unless control joints are indicated.
3. Do not exceed 50 feet in either direction, between ceiling control joints.
4. Install a control joint where framing or furring changes direction.
5. Do not exceed 30 feet between control joints in walls or wall furring.
6. Install a control joint where a control or expansion joint occurs in base exterior wall.
7. Install horizontal control joints in stairways at each floor line.
8. Wall or partition full height door frames (extending from floor to underside of ceiling system) shall be considered as control joints at both jambs.
9. 1/4-inch joints properly filled with sealant at internal corners of walls and partitions may be considered a control joint.

B. Install corner bead at exterior corners.

C. Install edge trim where edge of gypsum wallboard panels would be otherwise exposed.

D. Install special trim where indicated.

3.10 ACOUSTICAL SEALANT INSTALLATION

A. Install acoustical sealant at gypsum wallboard partition work.

B. Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

C. In lieu of acoustical sealant, construction joints at perimeter and within fire rated partition shall be firestopped per Firestopping: Division 7.

D. Apply a 3/8 inch diameter bead of sealant to both sides of runner tracks and end studs to seal interface with adjoining structure.

E. Seal interface between gypsum wallboard and other materials.

F. Apply sealant to perimeter of openings in gypsum wallboard for switches, convenience outlets, light fixtures, diffusers and registers, piping and similar sources of acoustical leakage.

G. Tool exposed sealant flush.

3.11 FINISHING

A. General: Treat gypsum wallboard joints, interior angles, and flanges of corner beads, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum wallboard surfaces for decoration.

B. Prefill open joints, rounded or beveled edges, and damaged areas using setting-type joint compound.

C. Apply joint tape over gypsum wallboard joints except those with accessories having concealed face flanges not requiring taping to prevent cracks from developing in joint treatment at flange edges.

D. Apply the various levels of finish of gypsum wallboard surfaces per GA-214 as follows: Comply with surface finish tolerance indicated.

1. Level 0 "Zero": No taping, finishing or accessories required. Provide this level for temporary construction.

2. Level 1: Joints and interior angles shall have tape embedded in joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable.

   a. Provide this level for plenum areas above ceilings, in attics, in areas where assembly will be concealed in Finished Work.
   b. Maximum 1/4-inch gap under a 10-foot straight edge at any point.

3. Level 2: Joints and interior angles shall have tape embedded in joint compound and one (1) separate coat of joint compound applied over joints, angles, fastener heads, and accessories. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable.

   a. Use this level in the following spaces: Utility Rooms, Electrical and Telecommunitcations Closets.
   b. Maximum 1/4-inch gap under a 10-foot straight edge at any point.

4. Level 3: Joints and interior angles shall have tape embedded in joint compound and two (2) separate coats of joint compound applied over joints, angles, fastener heads, and accessories. Joint compound shall be smooth and free of tool marks and ridges.

   a. Provide this level on surface indicated on Room Finish Schedule to receive the following finishes: Janitor's Closets
   b. Maximum 3/16-inch gap under a 10-foot straight edge at any point.

5. Level 4: Joints and interior angles shall have tape embedded in joint compound and three (3) separate coats of joint compound applied over joints, angles, fastener heads, and accessories. Furnished joint compound shall be smooth and free of tool marks and ridges.

   a. Provide this level, unless otherwise indicated.
   b. Maximum 1/8 inch gap under a 10-foot straight edge at any point.

6. Level 5: Joints and interior angles shall have tape embedded in joint compound and three (3) separate coats of joint compound applied over joints, angles, fastener heads, and accessories. A thin skim coat of joint compound, or a material manufactured especially for this purpose, shall be applied to entire surface to fill imperfections in joint work, smooth paper texture, and provide a uniform surface for decorating. Surface shall be smooth and free of tool marks and ridges.

   a. Provide this level of finish in the following spaces Level One Entrance Vestibule, Entrance Lobby, Elevator Lobby and Conference Room.
   b. Maximum 1/16 inch gap under a 10 foot straight edge at any point.

3.12 CLEANING AND PROTECTION

A. Promptly remove residual joint compound from adjacent surfaces.

B. Provide final protection and maintain conditions, in a manner suitable to Installer that ensures gypsum wallboard assemblies remain without damage or deterioration at Date of Substantial Completion.

END OF SECTION 092900

SECTION 093013 CERAMIC TILE

Part 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Applicable Sections: Division 1.

C. Dimensional Stone: Division 4.

D. Gypsum Wallboard Assemblies: Division 9.

1.2 SUMMARY (NON-INCLUSIVE)

A. Section Includes:

1. Ceramic floor tile.
2. Ceramic wall tile.
3. Stone thresholds installed as part of tile installations.
4. Waterproof membrane for thin-set tile installations.
5. Crack-suppression membrane for thin-set tile installations.
6. Finish Legend: See Drawings.

1.3 SUBMITTALS

A. Submit per the requirements of Division 1.

B. Product Data: Submit for record only, each material and accessory product. Show provisions for conformance with indicated criteria.

C. Samples:

1. Initial Selection: Submit for approval per requirements of Division 1, each type of tile and grout indicated. Include Samples of accessories involving color selection.
2. For Verification:
   a. Full-size units of each type and composition of tile and for each color and finish required.
   b. Assembled Samples with grouted joints for each type and composition of tile and for each color and finish required, minimum 12 inches square and mounted on rigid panel. Use grout of type and in color or colors approved for completed work.
   c. Stone thresholds in 6-inch lengths.
   d. Metal edge strips in 6-inch lengths.

D. Qualifications: Proof of compliance with indicated qualifications.

E. Quality Control Procedures:

1. Material Test Reports: For each tile-setting and -grouting product.

F. Closeout Submittals:

1. Maintenance Instructions: Flooring manufacturer's maintenance instructions.

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1.4 DEFINITIONS

A. Module Size: Actual tile size (minor facial dimension as measured per ASTM C 499) plus joint width indicated.

B. Facial Dimension: Actual tile size (minor facial dimension as measured per ASTM C 499).

C. Facial Dimension: Nominal tile size as defined in ANSI A137.1.

D. Wet Areas: As defined by Tile Council of America (TCA).

1.5 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:

1. Level Surfaces: Minimum 0.6.

2. Step Treads: Minimum 0.6.

3. Ramp Surfaces: Minimum 0.8.

1.6 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Minimum five (5) years producing products similar to those required for this Project.

B. Source Limitations for Tile: Obtain all tile of same type and color or finish from one (1) source or producer.

1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.

C. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one (1) source or producer.

D. Source Limitations for Other Products: Obtain each of the following products specified in this Section through one (1) source from a single manufacturer for each product:

1. Stone thresholds.

2. Waterproofing.

3. Joint sealants.

4. Certify compliance. Include project descriptions with Owner and Design Professional contacts and telephone numbers for previous experience and resume for designer.

E. Installer's Qualifications:

1. Experience: Minimum five (5) years installing products similar to those required for this Project. Completed three (3) projects of scope, schedule and complexity similar to this Project within last two (2) years as acceptable to Design Professional.

F. Referenced Codes and Standards: Comply with the following in accordance with Division 1.

1. Tile Council of America (TCA)
2. Ceramic Tile Installation Handbook

G. Certifications: Manufacturer shall certify in writing the following:

1. Certify installer qualifications.

Certify single source responsibility.

H. Mock-ups:

1. Approval: Obtain Owner's Representative's approval before commencing remainder of Work.
2. Location: In Toilet Room as determined with Contractor.
3. Extent: Floor: Minimum 8 feet by full width of Toilet Room.
4. Disposition: Approved mock-up may be incorporated into Final Work. Maintain in approved condition until Date of Substantial Completion.

1.7 DELIVERY, HANDLING AND STORAGE

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement in ANSI A137.1 for labeling sealed tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained, and contamination avoided.

D. Store liquid latexes in unopened containers and protected from freezing.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.8 FIELD CONDITIONS

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement in ANSI A137.1 for labeling sealed tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained, and contamination avoided.

D. Store liquid latexes in unopened containers and protected from freezing.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.9 SPECIAL WARRANTY

A. General: Warranty shall not deprive Owner of rights under other provisions of Contract and shall be in addition to, and run concurrent with, other Warranties made by Contractor under requirements of Contract Documents.

B. Warranty: Written Warranty, executed by manufacturer agreeing to repair or replace components of waterproofing, crack suppression system including cracked tiles that fail in materials or workmanship within specified Warranty Period.

1. Specified Warranty Period: Three (3) years from Date of Substantial Completion.

1.10 MAINTENANCE

A. Extra Materials: Furnish extra materials described below that match product installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size indicated.

Part 2 PRODUCTS

2.1 PRODUCT GENERAL

A. Provide recycled content materials in accordance with Sustainability Action Plan specified in Sustainability Requirements: Division 1 and as indicated below.

B. Provide regional materials in accordance with Sustainability Action Plan specified in Sustainability Requirements: Division 1.

C. Use adhesives and sealants that comply with the VOC limits specified in Sustainability Requirements: Division 1.

D. Use paints and coatings that comply with the VOC limits and chemical restrictions specified in Sustainability Requirements: Division 1.

E. ANSI Ceramic Tile Standard: ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements, unless otherwise indicated.

2. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Article, "Definitions".

F. Factory Blending: For tile exhibiting color variations within ranges selected during Sample submittals, blend tile in factory and package so tile units taken from one (1) package show same range in colors as those taken from other packages and match approved Samples.

G. Furnish ceramic and porcelain tiles for each type from same dye lot.

H. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless otherwise indicated.

2.2 TILE PRODUCTS

A. Refer to Finish Legend on Drawings for Ceramic Tile Schedule. No substations

B. All specified in tile schedule tiles to be rectified. No substitutions

C. All specified in tile schedule tiles to be from the same batch and caliber

2.3 TRIM UNITS

A. Glazed Wall Tile Trim Units: Matching characteristics of adjoining flat tile and coordinated with sizes and coursing of adjoining flat tile where applicable.

1. Base for Thin-Set Mortar Installations.

2. Base for Medium-Set Mortar Installations.

2.4 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

1. Bevel edges at 1:2 slope, aligning lower edge of bevel with adjacent floor finish. Limit height of bevel to 1/2 inch or less, and finish bevel to match face of threshold.

B. Marble Thresholds: ASTM C 503 with a minimum abrasion resistance of 10 per ASTM C 1353 or ASTM C 241 and with honed finish.

1. Description: Uniform, fine- to medium-grained white stone with gray veining.

2. Description: To match dimensional stone pavers as Specified in Dimensional Stone: Division 4.

2.5 WATERPROOFING AND CRACK-SUPPRESSION MEMBRANE

A. General: Manufacturer's standard product that complies with ANSI A118.10 Contractor's option selected from the following.

B. Chlorinated Polyethylene Sheet: Nonplasticized, chlorinated polyethylene faced on both sides with high-strength, nonwoven polyester fabric, for adhering to latex Portland cement mortar; 60 inches wide by 0.030 inch nominal thickness.

C. Product: Noble Company (The); Nobleseal TS.

D. PVC-Sheet: Two (2) layers of PVC sheet heat-fused together and to facings of bondable nonwoven polyester, for adhering to latex Portland cement mortar; 60 inches wide by 0.040-inch nominal thickness.

E. Product: Compotite Corporation; Composeal Gold.

F. Fabric Reinforced, Fluid Applied Product: System of liquid latex rubber and fabric reinforcement.

1. Products:

a. Custom Building Products; Trowel & Seal Waterproofing and Anti-Fracture Membrane.
b. Laticrete International Inc.; Laticrete 9235 Waterproof Membrane.
c. Mapei Corporation; PRP M19.
d. Summitville Tiles, Inc.; S-9000.

G. Crack Suppression Membrane:

1. General:

a. Review project conditions with Manufacture to determine appropriate system thickness based on existing field conditions.
b. Contractor shall repair and or replace existing conditions based on recommendations from the Manufacture.

2. Acceptable Manufacturer: Schluter Systems, L.P., 194 Pleasant Ridge Road, Plattsburgh, NY 12901-5841. ASD. Tel: (800) 472-4588. Fax (800) 477-9783.

3. Description: 1/8-inch-thick or 9/32 inch thick, orange, high-density polyethylene membrane with a grid structure of 1/2 inch by 1/2 inch square cavities, each cut back in a dovetail configuration, and a polypropylene anchoring fleece laminated to its underside. Conforms to definition for uncoupling membranes in the Tile Council of North America Handbook for Ceramic Tile Installation and is listed by CUPC to meet or exceed the requirements of the "American national standard specifications for load bearing, bonded, waterproof membranes for thin-set ceramic tile and dimension stone installation A118.10 and is listed by CUPC, and is evaluated by ICC-ES (see Report No. ESR-2467).

4. Waterproofing Membrane:

   a. Provide Schluter KERDI waterproofing membrane, min 8 mil thick, orange polyethylene membrane with polyproplyene fleece laminated on both sides.
   b. Provide Schluter KERDI system strips, seams and corners, min 4 mil thick, orange polyethylene membrane, with polypropylene fleece laminated on both sides.

2.6 SETTING MATERIALS

A. Latex-Portland Cement Mortar, Medium-Bed: Physical properties equaling or exceeding those required for thin-set mortars based on testing of medium-bed specimens according to ANSI A118.4:

1. Type: Contractor's Option of the following:

   a. Prepackaged dry-mortar mix containing dry, redispersible, ethylene vinyl acetate additive to which only water must be added.
   b. Prepackaged dry-mortar mix combined with acrylic resin liquid-latex additive.

2. Applications: Floor.

B. Latex Portland Cement Mortar, Thin Set: ANSI A118.4:

1. Type: Contractor's option of the following:

   a. Prepackaged dry-mortar mix containing dry, redispersible, ethylene vinyl acetate additive to which only water must be added.
   b. Prepackaged dry-mortar mix combined with acrylic resin liquid-latex additive.

2. Applications: Wall.

   a. Nonsagging mortar, comply with Paragraph F-4.6.1 in ANSI A118.4.

C. Latex Portland Cement Mortar, Medium Set: ANSI A118.4:

1. Type: Contractor's option of the following:

   a. Prepackaged dry-mortar mix containing dry, redispersible, ethylene vinyl acetate additive to which only water must be added.
   b. Prepackaged dry-mortar mix combined with acrylic resin liquid-latex additive.

2.7 GROUT MATERIALS

A. Latex Portland Cement Grout: ANSI A118.6.

1. Polymer Type: Ethylene vinyl acetate, in dry, redispersible form, prepackaged with other dry ingredients, or acrylic resin or styrene-butadiene rubber in liquid-latex form for addition to prepackaged dry-grout mix.

   a. Unsanded grout mixture for joints 1/8 inch and narrower.
   b. Sanded grout mixture for joints 1/8 inch and wider.

B. Grout Color: Submit grout color samples to Design Professional for selection. Allow one (1) color of grout for each type of tile.

2.8 MISCELLANEOUS MATERIALS

A. Water: Potable and free of harmful materials in deleterious amounts.

B. Underlayment: Latex-modified, Portland cement-based formulation provided or approved in writing by manufacturer of tile-setting materials for installations indicated.

C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved in writing for materials and installations indicated by tile and grout manufacturers.

D. Grout Sealer: Product recommended in writing by grout manufacturer for sealing grout joints that does not change color or appearance of grout.

2.9 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturer's written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

Part 3 EXECUTION

3.1 EXAMINATION

A. Project Site Verification of Conditions:

1. Substrates: Examine for conformance to requirements indicated for that substrate.

    a. Penetrations: Verify that penetrations, sleeves, block-outs and similar items are set properly.
    b. Verify that substrates for setting tile are firm, dry, clean, free of oil, waxy films and curing compounds.
    c. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
    d. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Design Professional.

B. Conditions: Report to Contractor prior to commencing Work.

C. Corrections: Perform corrections as directed by Contractor and Owner's Representative.

D. Acceptance: Commencing installation constitutes acceptance of substrate as suitable. Provide Work required because of installation over deficient or defective substrates at no additional cost.

3.2 PREPARATION

A. Protection: Protect adjacent surfaces from staining, deterioration or damage.

B. Surface Preparation: Prepare surfaces as required to make ready for application of tile and setting materials. Comply with manufacturer's written requirements.

1. Make substrate suitable to provide Finished Work matching approved Samples and Mock-up.
2. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.
3. Prepare concrete substrates to comply with flatness tolerances specified in referenced ANSI A108 Series of tile installation standards.
    a. Fill cracks, holes, and depressions with underlayment according to tile-setting material manufacturer's written instructions.
    b. Remove protrusions, bumps, and ridges by sanding or grinding.
    c. Build ramps to align top of tile with other finished floors. Slope ramps at not to exceed 1:50. (1/4 inch per foot).

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

D. Temporary Protective Coating: Where needed to prevent grout from staining or adhering to exposed tile surfaces, precoat with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 INSTALLATION

A. General: Install as required to:

1. Comply with manufacturer's written instructions.
2. Comply with approved submittals.
3. Match approved Mock-ups.
4. Comply with indicated criteria.
5. Comply with requirements of TCA's "Handbook for Ceramic Tile Installation." and ANSI A108 Series "Specifications for Installation of Ceramic Tile" except where more stringent standards are indicated elsewhere.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Jointing Pattern: Lay tile in staggered pattern, unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting and tiles less than half size. Provide uniform joint widths, unless otherwise indicated.

E. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Locate joints in tile surfaces directly above joints in concrete substrates.
2. Prepare joints and apply sealants to comply with requirements in Joint Sealants: Division 7.

F. Thickset methods: Use latex-Portland cement mortar when thin-set option over latex Portland cement mud bed is Contractor's selected option within indicated system.

G. Grout: Grout using latex Portland cement grout, comply with ANSI A 108.10, unless otherwise indicated.

3.4 WATERPROOFING INSTALLATION

A. Install waterproofing to comply with ANSI A108.13 and waterproofing manufacturer's written instructions to produce waterproof membrane of uniform thickness bonded (minimum 95 percent) to substrate.

B. Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

C. Extend membrane up walls 6 inches minimum where walls will be tiled. Where walls will receive tile base only, stop membrane 1/2 inch below top of base.

D. Cure membrane and protect from damage until floor tile is installed.

3.5 CRACK-SUPPRESSION MEMBRANE INSTALLATION

A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.

B. Non-Moving Cracks and Joints: Prepare control joints and construction joints in substrates indicated on Drawings and additional joints resulting from Contractors operations. Prepare stable shrinkage cracks in substrates.

C. Active Movement Joints: Prepare joints over 3/4 inch in width, concrete isolation joints, and expansion joints in substrates indicated on Drawings and additional joints resulting from Contractors operations. Prepare actively moving cracks in substrates.

D. Allow crack isolation membrane to cure before installing tile or setting materials over it.

3.6 FLOOR TILE INSTALLATION

A. Mortar Coverage: For installations indicated below, follow procedures in ANSI A108 Series tile installation standards for providing 95 percent mortar coverage.

1. Tile floors in wet areas.
2. Tile floors composed of tiles 8 inches by 8 inches or larger.
3. Tile floors composed of rib-backed tiles.

B. Joint Widths: Install tile on floors with the following joint widths:

1. Tile: 1/16 inch.

C. Stone Thresholds: Install stone thresholds at locations indicated; set in same type of setting bed as abutting field tile, unless otherwise indicated.

D. Grout Sealer: Apply grout sealer to latex Portland cement grout joints according to grout-sealer manufacturer's written instructions. Remove excess sealer as soon as grout sealer has penetrated grout joints.

E. Typical Waterproof Interior Floor Installation: Latex Portland cement medium set mortar; TCA F113 and ANSI A108.5.

3.7 WALL TILE INSTALLATION

A. Joint Widths: Install tile on walls with the following joint widths:

1. Tile: 1/16 inch for rectified tiles
2. Tile: 1/8 inch for all other tiles

B. (Contractor's Option) Interior Wall Installation Over Cementitious Backer Units: Latex Portland cement thin-set mortar; TCA W244 and ANSI A108.5.

1. Use for all interior walls, unless otherwise indicated.

C. (Contractor's Option) Interior Wall Installation Over Glass-Mat, Water-Resistant Backer Board: Latex Portland cement thin-set mortar, TCA W245 and ANSI A108.5.

1. Use for all interior walls, unless otherwise indicated

3.8 FIELD QUALITY CONTROL

A. Tolerances:

1. General: Comply with more stringent tolerances than those listed below to match approved Mock-up.
2. Reference Standards: Comply with tolerances listed in Ceramic Tile Installation Handbook, published by Tile Council of America (TCA) except where more stringent written requirements are indicated.

B. Manufacturer's Field Services: Manufacturer's authorized representative shall:

1. Visit Project Site as follows:
   a. During initial start of Work and examination of substrates.
   b. Upon completion of Work of this Section.
2. Instruct installer on, for example, proper means, methods, materials and techniques.
3. Report: Submit to Contractor within three (3) working days.

3.9 CLEANING AND PROTECTING

A. Cleaning: On completion of grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.
2. Clean grout smears and haze according to tile and grout manufacturer's written instructions, but no sooner than ten (10) days after installation. Use cleaners recommended in writing by tile and grout manufacturers and after determining that cleaners are safe to use by testing on Samples of tile and other surfaces to be cleaned. Protect adjacent surfaces from cleaning. Flush surfaces with clean water before and after cleaning.
3. Remove temporary protective coating by method recommended in writing by coating manufacturer that is acceptable in writing to tile and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

B. When recommended in writing by tile manufacturer, apply per manufacturer's written instructions a neutral protective cleaner to completed tile walls and floors.

C. Protect installed tile work with heavy covering.

D. Prohibit foot and wheel traffic from tiled floors for at least seven (7) days after grouting is completed.

E. Before final inspection and Date of Substantial Completion, remove protective coverings and rinse neutral cleaner from tile surfaces.

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END OF SECTION 093013

SECTION 095123 ACOUSTICAL CEILINGS

Part 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Applicable Sections: Division 1.

C. Gypsum Wallboard Assemblies: Division 9.

D. Finish Legend: See Drawings.

1.2 SUMMARY (NON-INCLUSIVE)

A. Section Includes: Acoustical ceiling (AC) and suspension systems.

1.3 SUBMITTALS

A. Submit for record only per the requirements of Division 1.

B. Product Data: Manufacturer's data and test reports containing sufficient evidence of conformance to classes, ratings, performances and other indicated criteria. Data for anchors into structure and for concealed steel framing containing sufficient evidence of conformance to indicated criteria.

C. Samples:

1. Panels: Two (2), 12 inch square Samples of each type of panel.

2. Suspension System: Two (2), 12 inch long Samples of each type of grid component.

D. Qualifications: As indicated.

E. Certifications:

1. Fire Rating Certification: Test certificates, showing name of test, testing agency and test number as evidenced of compliance to fire-resistance ratings indicated.

F. Sustainability Submittals: Provide the following in accordance with Sustainability Requirements: Division 1.

1. Materials Sustainability Documentation Form.

2. Product data, certification letter, and costs for materials with recycled content.

3. Product data and costs for regional materials.

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1.4 QUALITY ASSURANCE

A. Installer's Qualifications: Installer shall have minimum five (5) years experience installing products similar to those required for this Project. Installer shall have documented experience of successfully completing three (3) projects of scope, schedule and complexity similar to this Project within last two (2) years. Submit qualifications on Installer's letterhead. Include project descriptions with Owner and Design Professional contacts and telephone numbers for previous experience.

B. Single Source Requirements: Panel products required for Work of this Section shall be supplied by one (1) manufacturer. Suspension grid products required for Work of this Section shall be supplied by one (1) manufacturer of accessory products including, for example, fasteners, sealants and anchors may be from other than primary manufacturer if approved in writing by primary manufacturer.

C. Regulatory Requirements: Components of fire-rated assembly shall comply with a listed assembly of required fire-rating of Underwriters Laboratories, Inc. or other independent Testing Agency approved by Building Code Official having jurisdiction.

D. Referenced Codes and Standards: Comply with Ceiling and Interior Systems Contractors Association (CISCA): CISCA Ceiling Systems Handbook "Recommendations for Direct Hung Ceilings" in accordance with Division 1.

1.5 DELIVERY, HANDLING AND STORAGE

A. Deliver acoustical tiles, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical tiles, permit them to reach room temperature and a stabilized moisture content for at least 24 hours.

C. Exercise personal and mechanical cleanliness to prevent soiling of ceiling material. Wear clean white gloves while handling panels.

1.6 FIELD CONDITIONS

Environmental Requirements: Building areas to receive ceilings shall be free of construction dust and debris. Maintain temperature and Relative Humidity within limits recommended in writing by manufacturer, before, during and after installation. Do not install acoustical tile ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical tile ceiling installation.

1.7 SEQUENCING

A. Work above ceiling grid shall be substantially completed before commencing installation of grid system.

1.8 MAINTENANCE

A. Extra Materials: Deliver to Project Site, at completion of Project, extra acoustical panels and grid of each type used. Furnish acoustical units from same production run of that provided for installation. Quantities of each material shall be full-carton lots as follows:

	Project Area, Per Type of Work	**Extra Materials**
1.	5,000 square feet or less	100 square feet of panel and 2 percent of grid.
2.	5,000-15,000 square feet	150 square feet of panel and 2 percent of grid.

B. When more than one (1) type of acoustical panel or grid are required, furnish each type in a quantity corresponding to area dedicated for the type.

C. Furnish extra stock quantities in addition to normal overrun quantities required for completion of Work.

Part 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Provide recycled content materials in accordance with Sustainability Action Plan specified in Sustainability Requirements: Division 1 and as indicated below.

B. Provide regional materials in accordance with Sustainability Action Plan specified in Sustainability Requirements: Division 1.

C. Do not use products or adhesives that contain urea-formaldehyde resin.

2.2 MANUFACTURERS

A. Products of indicated manufacturers are acceptable, contingent upon conformance to indicated requirements. Equivalent products of other manufacturers will be evaluated as substitutions in accordance with requirements of Division 1.

2.3 SUSPENSION SYSTEMS: GENERAL

A. Suspension Grid: Provide metal suspension systems of types, structural classifications and finishes indicated that comply with ASTM C 635.

1. Structural Classification: Intermediate Duty.

2. Seismic Clips: Metal Clips to secure grid members to edge angle per the requirements of ASTM E 580.

B. Edge Molding and Trim:

1. Material and Finish: Match grid, profiles as indicated.

2. Edge Trim:

   a. Lay-in Panels with Exposed Grid and Concealed Spline Systems: Standard edge angle.
   b. Narrow Faced or Reveal Face Suspension Systems: Edge angle that matches width of exposed suspension members.
   c. Circular Penetrations and Curved Edges: Factory form edge angle to indicated radius smooth and true without kinking or notching.
   d. Monolithic acoustic panel system installation: Edge angle size and profile as indicated on drawings.

3. Foam Tape: 1/8 inch by 1 inch foam tape, adhesive coated one (1) side, for sealing edge trim.

C. Steel Framing Accessories:

1. Concealed Steel Framing:

   a. Channels: Cold-rolled steel, 0.055 inch minimum thickness of base (uncoated) metal, 1 1/2 inches deep, 1/2 inch wide flanges, black varnish finish.
   b. Slotted Steel Channels: Unistrut or equivalent.
   c. Load Capacity: Five (5) times design load indicated in ASTM C 635, Table 1, Direct Hung for required span.

2. Screws: Corrosion-resistant coated steel drill screws.

a. For Wood and Steel Less Than 0.03 inch: ASTM C 1002.
b. For Steel Over 0.03 inch: ASTM C 954.

3. Anchors into Steel:

a. Self-drilling or self-tapping screw type anchors, through-bolts, or clamp-on type anchors fabricated from corrosion-resistant materials.
b. Load Capacity: Five (5) times design load indicated in ASTM C 635, Table 1, Direct Hung.

4. Powder-Actuated Fasteners into Concrete or Steel:

a. Corrosion-resistant fastener plus clip or washer as required to suit application.
b. Load Capacity (per ASTM E 1190): Ten (10) times-imposed load indicated in ASTM C 635, Table 1, Direct Hung.

5. Wire for Hanger and Ties: ASTM A 641, Class 1 zinc coating, soft-temper, minimum 12 gage for hangers and 16 gage for ties.

6. Rod and Strap Hangers: Galvanized, soft-temper steel, sizes as indicated.

2.4 ACOUSTICAL MATERIALS: GENERAL

A. Units shall comply with ASTM E 1264 classifications as designated by type, pattern, acoustical ratings and light reflectance.

B. Flame Spread and Smoke Developed: Maximum ratings of 25 and 450 when tested in accordance with ASTM E 84.

C. NRC ratings specified shall be in accordance with ASTM C 423.

2.5 EDGE TRIM

A. Extruded Aluminum Shapes:

1. Basis of Design: Axiom by Armstrong.

2. Size: Vertical face as indicated.

3. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils. Comply with ASTM C 635/C 635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.6 ACCESSORIES

A. Spring Spacers: Cold-rolled spring steel for use in concealed spline tile installations.

B. Hold-Down Clips: Cold-rolled spring steel suitable for lay-in panel installations.

C. Access Tabs: Sheet metal devices, painted white, for moving along kerf edge of tile to permit removal of an individual tile unit.

D. Gasket: Scotch foam No. 4314, 1/4-inch single coated foam tape manufactured by the 3M Corporation.

E. Acoustical Sealant: As specified in Section 079200 "Acoustical Joint Sealants."

2.7 ACOUSTICAL CEILING SYSTEMS

A. Refer to Finish Legend on Drawigns for Acoustical Ceiling Legend.

Part 3 EXECUTION

3.1 EXAMINATION

A. Project Site Verification of Conditions:

1. Examine substrates, areas, and conditions, including structural framing and substrates to which acoustical tile ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
2. Report deficiencies to Contractor prior to commencing Work.
3. Commencing Work constitutes acceptance of substrates and structural framing. Perform work or re-work required because of deficient substrates at no additional cost.

3.2 PREPARATION

A. Preset Inserts: Furnish inserts for concrete, clips, and other similar ceiling anchors to appropriate trades for installation. Coordinate layout.

B. Fire Protection: Coordinate attachment to members protected with fireproofing, including spray-on, intumescent, board, gypsum wallboard assembly, or other types, in order to maintain indicated ratings. Install clips or anchorage before application of fire protection, in manner which maintains rating or patch fire protection.

C. Layout:

1. Comply with reflected ceiling plans.
2. If dimensions are not indicated, establish layout of grid to balance border widths at opposite edges of each ceiling.
3. Avoid installation of less-than-half width units.

3.3 SUSPENSION SYSTEM INSTALLATION

A. General: Install in accordance with manufacturer's written instructions and to comply with referenced standards and ASTM C 636/ C636M

B. Overhead Anchors: Where it is not possible to wire-tie directly to structure or preset inserts, install overhead anchors in accordance with manufacturer's written instructions. Do not anchor to metal roof decks.

C. Edge Moldings: At perimeter, penetrations, junctions with other ceiling surfaces, and the intersection of ceiling and any vertical surfaces, install edge molding of type indicated.

1. Set edge angle over continuous foam tape.
2. Use maximum lengths.
3. Miter corners.
4. Anchor at maximum 24 inches on center and within 3 inches {75 mm} of each end with screws. Nails are not acceptable. At metal stud partitions, anchor into studs where possible.

D. Hangers:

1. Suspend hangers directly from structure, or from anchors.

a. Wire hanger loops shall be tightly wrapped and sharply bent to prevent vertical movement or rotation. Wrap wire around itself minimum three (3) full turns within 3 inches.
b. Do not attach hangers to other systems within ceiling space or their system supports, including ductwork, piping and conduit.

2. Hangers shall be one-piece without splices.

3. Install hangers free from contact with other objects within ceiling space not part of supporting structural system or ceiling system. Do not kink or bend hangers.

4. Hanger wires shall not be more than 1 in 6 out of plumb, unless countersplayed hangers at approximately same slope and in same plane are provided.

E. Supplemental Framing:

1. Where structural members are spaced more than 4 feet on center or otherwise do not align with required hanger suspension points and other overhead anchors are not available, provide supplemental framing to bridge between the structural members.

2. Where ducts or other elements prevent the regular spacing of hangers, provide a trapeze to span under interrupting element.

3. Supplemental Framing and Trapezes: Suspend, anchor or weld to structure at both ends to prevent rotation, sizes as follows:

a. Spans up to 4 feet: One (1) cold-rolled channel, vertical with wire hangers each end.
b. Spans over 4 feet up to 6 feet: Doubled cold-rolled channels, wired together, vertical, with 1/8 inch by 1-inch bolted strap hangers each end.
c. Spans over 6 feet: Slotted steel channel, sized for span and load condition, with 3/8-inch threaded rod hangers each end.

F. Seismic Requirements: Comply with requirements of ASTM E 580. In each ceiling area over 144 square feet, provide the following treatments to allow for seismic loading. Areas less than 144 square feet shall be installed per normal requirements of this Section.

1. Support each main grid tee and each cross tee with a hanger within 8 inches of perimeter edge trim.

2. At two (2) adjacent edges, secure tees to edge trim with a concealed seismic clip or by wire tying. Do not use an exposed fastener.

3. At two (2) adjacent edges opposite anchored tees, allow minimum 1/4 inch clear space for movement and provide a continuous spacer bar wired to top of each tee.

4. Bracing: In ceiling areas over 400 square feet brace ceiling for horizontal movement.

a. Secure four (4) hanger wires to main tee within 2 inches of a cross tee. Space the hangers at 90 degrees in plan and slope at maximum 1 to 1 from plane of ceiling. Anchor each wire to structure, preset inserts or anchor.
b. Space bracing at maximum 12 feet on center each direction.
c. First rows of bracing shall be within 4 feet of ceiling perimeter.

G. Fixtures, Diffusers and other Elements Attached to Ceiling: Provide hangers within 6 inches of support points of grid-mounted light fixtures.

H. Fire-rated Systems: In addition to requirements of this Section, comply with requirements of Independent Test Report to provide system of indicated fire-rating.

3.4 PANEL INSTALLATION

A. Install Work in accordance with manufacturer's written instructions.

B. Cull out and discard irregular, broken, off-color, and poorly textured units.

C. Intermingle ceiling material from several cartons to disperse slight variations over a large area.

D. Run grain of ceiling units in one (1) direction within each room and space as indicated.

E. Scribe and cut for accurate fit at borders and around penetrating Work.

1. At panels with reveal type edges or edge profiles other than square, route or trim field cut edges to match factory edge using special tools or methods.

2. Paint cut edges to match ceiling panels prior to installation.

F. Spring Spacers: At perimeter of concealed spline tile ceilings, provide spring spacers between edge of tile and perimeter angle molding, to prevent tile separation.

G. Hold-Down Clips: At lay-in panel ceilings, provide hold-down clips on top of panel [10 feet] {3 m} from exterior doors on all panels.

3.5 TOLERANCES

A. No portion of installed ceiling shall deviate from a true horizontal plane by more 1/8 inch in 12 ft non-cumulative.

B. Joints between and within grid members and edge trim shall be 1/16 inch maximum.

C. Grid members shall not deviate from an idealized plan location by more than 1/4 inch in 10 feet.

3.6 ADJUSTMENTS AND CLEANING

A. Adjust sags or twists which develop in ceiling systems.

B. Minor marks on panels may be removed if cleaning method does not damage surface. Use of spackling or paint to hide defect is not acceptable.

C. Touch up minor damage to grid finish with manufacturer's written recommended paint. Touch-ups shall be invisible when viewed from normal standing eye level under normal lighting conditions.

D. Replace with new material, any Work which is damaged, soiled, abraded, chipped, broken or discolored.

END OF SECTION 095123

SECTION 09 62 00
SPECIALTY FLOORING

PART 1 GENERAL

1.1 SUMMARY

A. This section includes wood and resilient specialty dance flooring and floor preparation.

1.2 COORDINATION

A. Coordinate layout and installation of slab depressions to accommodate layout and height of wood and resilient dance flooring assembly.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Samples: Submit two representative samples of each material specified indicating visual characteristics and finish. Include range samples if variation of finish is anticipated.

C. Shop drawings: For each type of floor assembly, include the following:
   1. Plans, sections and attachment details.
   2. Details of concrete slab depressions.
   3. Expansion provisions and trim details.

D. Closeout Submittals: Include wood and resilient floor finish systems maintenance data.

1.4 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Mock-Ups: Provide in place mockup of system installation and finish floor for an 8'x8' section within each dance studio for approval. Mockup may become part of final installation if approved.

1.5 DELIVERY, STORAGE AND HANDLIING

A. Deliver floor assembly materials in unopened cartons or bundles.

B. Protect material from exposure to moisture. Do not deliver wood components until after concrete or other wet-work is complete and dry.

C. Store wood components in a dry, warm, well-ventilated weathertight location and in a horizontal position.

1.6 FIELD CONDITIONS

A. Conditioning period begins not less than seven days before wood athletic flooring installation, is continuous through installation, and continues not less than seven days after installation.

   1. Environmental Conditioning: Maintain ambient temperature between 65 and 75 degrees F and relative humidity planned for building occupants, but not less than 35 percent or more than 50 percent, in spaces to receive wood athletic flooring during the conditioning period.

   2. Wood Conditioning: Move wood components into spaces where they will be installed, no later

than beginning of the conditioning period.
a. Do not install wood flooing until wood components adjust to relative humidiy of, and are at same temperature as, spaces where they are to be installed.
b. Open sealed packages to allow wood components to acclimatize immediately on moving wood components into spaces in which they will be installed.

3. After conditioning period, maintain relative humidity and ambient temperature planned for building occupants.

4. Install wood athletic flooring after other finishing operations, including painting, have been completed.

PART 2 PRODUCTS

2.1 MATERIALS

A. Dance Studio 1 Flooring System:
1. Manufacturer: StageStep, 800.523.0960
2. Application: Sprung Marley Dance Floor
3. Subfloor: StageStep Springstep IV
4. Finish Floor: Super Bravo 2mm
5. Thickness: +/- 1 ½"
6. Color: Gray
7. Auxiliary Materials:
a. Vapor barrier
1) Provide liquid applied vapor barrier over concrete slab in accordance with manufacter's recommendations
b. Vented Base: Provide manufacturer's vented base at all flooring edge to wall conditions. Color to be selected from Manufacturer's standard color range.

B. Dance Studio 2 Flooring System:
1. Manufacturer: StageStep
2. Application: Sprung Hardwood Dance Floor
3. Subfloor: Stagestep Springflex beam system
4. Finish Floor: Hardwood Maple Dance Floor
5. Thickness: +/- 2 ¾"
6. Species: Maple
a. Maple Flooring: Comply with MFMA grading rules for species, grade and cut.
b. Certification: Provide flooring that carries MFMA mark on each bundle or piece.
7. Auxiliary Materials:
a. Vapor barrier
1) Provide liquid applied vapor barrier over concrete slab in accordance with manufacter's recommendations
b. Vented Base: Provide manufacturer's vented base at all flooring edge to wall conditions. Color to be selected from Manufacturer's standard color range.

C. Flooring finish: Provide flnish coat or floor finish sealer as recommended by manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Concrete Slabs: Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.

1. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
   a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
   b. Relative Humidity Test: Using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
   c. Perform additional moisture tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

3.2 PREPARATION

A. Concrete Slabs:
   1. Grind high spots and fill low spots on concrete substrates to produce a maximum 1/8-inch (3-mm) deviation in any direction when checked with a 10-foot (3-m) straight edge.
   2. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
   3. Remove coatings including curing compounds and other substances on substrates that are incompatible with installation adhesives and that contain soap, wax, oil, or silicone; use mechanical methods recommended by manufacturer. Do not use solvents.

B. Broom and vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.

B. Pattern: Lay flooring in parallel with long dimension of space to be floored unless otherwise indicated.

C. Provide control joints over joints in substrate and at approved locations.

D. Sand and finish wood flooring in accordance with manufacturer's recommendations.

E. Do not cover flooring until after finishing and until finish reaches full cure and not before seven days after applying last finish coat.

F. Restore damaged work. Replace work, which cannot be repaired. Clean and protect work from damage.

END OF SECTION

SECTION 096513 RESILIENT BASE

Part 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Applicable Sections: Division 1.

C. Cast-In-Place Concrete: Division 3.

D. Concrete Flatwork Finishing: Division 3.

E. Broadloom – Glue Down: Division 9.

F. Carpet Tile: Division 9.

G. Gypsum Wallboard Assemblies: Division 9.

H. Gypsum Shaftwall Assemblies: Division 9.

1.2 SUMMARY (NON-INCLUSIVE)

A. Section Includes: Flooring and accessories as follows:

1. Resilient Base (RB).
2. Finish Legend: See drawings

1.3 SUBMITTALS

A. Submit for record only per the requirements of Division 1.

B. Product Data: For each component or material required including accessories, anchors, and other miscellaneous products including written installation instructions.

C. Samples: Two (2) Samples per each material type. Tile or sheet material shall each be 12 inch by 12 inch.

D. Certifications: By each manufacturer that products meet specified requirement.

E. Sustainability Submittals: Provide the following in accordance with Sustainability Requirements: Division 1.

1. Materials Sustainability Documentation Form.
2. Product data, certification letter, and costs for materials with recycled content.
3. Product data and costs for regional materials.
4. Product data for adhesives and sealants indicating VOC content.
5. Product data for paints and coatings indicating VOC content and chemical composition.
6. Product data for products containing composite wood or agrifiber products or wood glues indicating that they do not contain urea-formaldehyde resin.

F. Closeout Submittals: Maintenance instructions for each product installed.

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1.4 QUALITY ASSURANCE

A. Grade: Materials shall be Regular Grade, an industry standard which represents best quality production available. Second quality or rejects are not acceptable.

B. Installer's Qualifications: Installer shall have minimum five (5) years' experience installing products similar to those required. Installer shall have documented experience of successfully completing three (3) projects of scope, schedule and complexity similar to this Project within last two (2) years.

C. Single Source Requirements: Supply each primary product required for Work of this Section from one (1) manufacturer. Accessory products including, for example, fasteners, sealants, and anchors shall be approved in writing by primary manufacturer.

D. Certifications: Cork flooring and adhesives must contain no added urea-formaldehyde resins.

E. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Coordinate mockups in this Section with mockups specified in other Sections.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, HANDLING AND STORAGE

A. Deliver to Project Site in original manufacturer unopened packaging, bearing name of product and manufacturer, shipping and handling instructions.

B. Store materials in dry space at between 55 degrees F and 90 degrees F.

C. Store tiles flat. Move tiles and accessories to final location 48 hours before installation.

1.6 FIELD CONDITIONS

A. Maintain temperature at 70 degrees F in spaces to receive materials specified herein 48 hours prior to installation. Maintain space at 55 degrees F after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer

1.7 MAINTENANCE

A. Extra Materials: Deliver to Owner's Representative, full-cartons of base for future use. Provide 2 percent of total quantity of each type and color used, but not less than two (2) full-cartons of each type and color, and 16 feet of each color base.

Part 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Provide recycled content materials in accordance with Sustainability Action Plan specified in Sustainability Requirements: Division 1 and as indicated below.

B. Do not use products or adhesives that contain urea-formaldehyde resin.

C. Use adhesives and sealants that comply with the VOC limits specified in Sustainability Requirements: Division 1.

2.2 RESILIENT BASE

A. Products of the following manufacturers are acceptable, contingent upon meeting indicated requirements. Equivalent products of other manufacturers will be evaluated as substitutions in accordance with requirements of Division 1.

1. Rubber Base: Refer to Finish Legend.

   a. Azrock Floor Products.
   b. Burke Rubber Company.
   c. Johnsonite Rubber Company.
   d. Nora Flooring Systems, Inc.
   e. Roppe.

2. . Vinyl Base: Refer to Finish Legend.

   a. Armstrong World Industries, Inc.
   b. American Biltrite Rubber Company.
   c. Roppe.
   d. GAF. B. Base:

B. 1/8 inch by maximum length. Provide rubber or vinyl base matching the colors indicated.

1. 1. RB-1: Basis of Design: Rubber Wallbase by Johnsonite.

   a. Height: 4 inches.
   b. Profile: Coved bottom lip, top-set type, except, use straight type at carpeted floors.
   c. Color: Refer to Finish Legend on Drawings for Resilient Base Schedule.

2.3 ACCESSORIES

A. Adhesives: Water-resistant types manufactured to be suitable for floors on grade, floors above grade, and for adhering base, as recommended in writing by tile and base manufacturers.

B. Underlayment: Type recommended in writing by floor tile manufacturer.

C. Edging: Solid vinyl, brown or black as selected, 1 inch wide by 1/8 inch thick, beveled.

Part 3 EXECUTION

3.1 EXAMINATION

A. Project Site Verification of Conditions:

1. Examine substrates for suitability and conformance to specified tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

2. Report any deficiencies to Contractor prior to commencing Work.

3. Commencing Work constitutes acceptance of substrate. Perform future work or re-work required because of deficient substrates at no additional cost.

B. Testing: Test substrate for moisture content per manufacturer's written instructions.

3.2 PREPARATION

A. Apply skim coat of underlayment to correct other irregularities, to fill joints flush and to correct minor defects in wall surfaces which receive base.

B. Do not install resilient products until materials are the same temperature as space where they are to be installed.

C. Acceptance: Commencing Work constitutes acceptance of substrate. Future work or re-work required because of deficient substrates will be performed at no expense to the Owner.

3.3 INSTALLATION

A. Adhere base as recommended in writing by manufacturer.

B. Install base straight and true and with neatly formed corners. Scribe base accurately to vertical surfaces.

C. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

D. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

E. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

F. Do not stretch resilient base during installation.

3.4 PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from surfaces.

2. Retain both subparagraphs below if stair accessories are included in this Section.

3. Sweep and vacuum horizontal surfaces thoroughly.

C. Damp-mop horizontal surfaces to remove marks and soil.

D. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

E. Protect installation until Final Cleaning and Date of Substantial Completion.

END OF SECTION 096513

SECTION 096813 CARPET TILE

Part 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Applicable Sections: Division 1.

C. Cast-In-Place Concrete: Division 3.

D. Concrete Flatwork Finishing: Division 3.

E. Broadloom – Glue-Down: Division 9.

F. Finish Legend: See Drawings.

1.2 SUMMARY (NON-INCLUSIVE)

A. Section Includes: Sub-floor preparation, carpet tile installation and carpet accessories.

1.3 SUBMITTALS

A. Submit for record only per the requirements of Division 1.

B. Product Data: Carpet Schedule: Prepare yardage take-off for each carpet color and/or patterns and submit in schedule form.

C. Samples: Three (3) full size carpet tile Samples of each type and color specified. Label Samples to identify color, quality of construction, manufacturer, project name and general area of installation.

D. Certifications:

1. Purchase Order: Copy of Dated Purchase Order, identifying Project and all materials.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:

1. Maintenance Instructions: Five (5) copies of carpet manufacturer's written instructions and recommendations for cleaning and maintenance.

2. Special Warranty: As indicated.

3. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.

4. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.5 PERFORMANCE REQUIREMENTS

A. Manufacturer's Instructions: Install Work in accordance with carpet tile manufacturer's written instructions. Should such recommendations conflict with these Specifications, so state in proposal. First stage of installation work for each carpet type shall be subject to approval, and Work approved shall be standard for remainder of installation.

1.6 QUALITY ASSURANCE

A. Installation shall be by installers approved in writing by manufacturers.

B. Environmental Performance Criteria:

1. Provide products which meet or exceed the requirements of the Carpet and Rug Institute Green Label Indoor Air Quality Test Program.
2. Provide products that contain a minimum recycled content by weight (post-consumer or post-industrial content) as specified.
3. Provide products which are maintainable without the use of harsh chemicals.

C. Manufacturer Recycling Program: Provide carpet materials only from manufacturers who have an established material reclamation and recycling program including:

1. Use of both post-consumer and post-industrial recycled materials in production of the carpet backing.
2. Provisions for reclamation of material supplied for this Project at the end of its useful life.

1.7 DELIVERY, HANDLING AND STORAGE

A. Comply with CRI's "CRI Carpet Installation Standard."

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1.8 FIELD CONDITIONS

A. Environmental Requirements: Maintain carpeting and spaces to be carpeted at a minimum of 8 degrees F for at least 48 hours prior to installation with Relative Humidity not over 65 percent. Maintain conditions 24 hours a day during installation and for 72 hours after completion.

B. Field Measurements: Field check dimensions and conditions and be responsible for proper installation of carpet. Dimensions indicated are approximate.

C. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.

D. Other Construction: Do not start carpet installation until painting and finishing work are completed, and ceilings and overhead work are tested and approved.

1.9 SPECIAL WARRANTY

A. Warrant carpet in writing for manufacturer's standard Warranty Period, as specified below. Warranty shall commence upon Date of Substantial Completion of carpet installation as determined by Design Professional. Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, the following:

a. More than 10 percent edge raveling, snags, and runs.
b. Dimensional instability.
c. Excess static discharge.
d. Loss of tuft-bind strength.
e. Loss of face fiber.
f. Delamination.

B. Wear: Five (5) years.

C. Static: Lifetime of carpet.

D. Edge Ravel: Five (5) years.

E. Delamination: Five (5) years.

F. Dimensional Stability: Five (5) years.

1.10 EXTRA MATERIALS

A. Deliver to Project Site, extra materials of each type of carpet used. Extra materials shall be from same production runs as that used in Work.

B. For each material provide as extra stock 5 percent minimum of quantity of that material used in Work.

C. Extra material shall be in addition to normal overrun quantities required for completion of Work.

Part 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Products specified in documents are meant to establish the desired quality and performance of Work. Equivalent products of other manufacturers will be evaluated as substitutions in accordance with requirements of Division 1.

2.2 GENERAL

A. Provide recycled content materials in accordance with Sustainability Action Plan specified in Sustainability Requirements: Division 1 and as indicated below.

B. Use adhesives and sealants that comply with the VOC limits specified in Sustainability Requirements: Division 1.

C. Carpet shall be new, first quality and from same dye lot colors selected. Carpeting shall have a critical radiant flux rating of 0.45 watts per square centimeter as tested in accordance with ASTM E 648 and NFPA 253

D. Weight: 26 ounces per square yard minimum.

E. Appearance Retention Rating: Moderate traffic, 2.5 minimum according to ASTM D 7330.

F. Dimensional Tolerance: Within 1/32 inch of specified size dimensions, as determined by physical measurement.

G. Dimensional Stability: 0.2 percent or less according to ISO 2551 (Aachen Test).

H. Refer to Finish Schedule: on Drawings.

2.3 CARPET TILE SCHEDULE

A. Refer to Finish Legend on Drawings for Carpet Tile Schedule.

2.4 ACCESSORY MATERIALS

A. Leveling Compound: Noncrumbling latex base patching compound. Volatile Organic Compounds (VOCs) compliant.

B. Floor Sealer: Floor sealers, as recommended in writing by carpet manufacturer, shall be compatible with adhesive used.

C. Contact Cement: "Grab-Plus", nonflammable type by Durabond Products or "Touchdown" No. 700 by W. F. Taylor Company. Volatile Organic Compounds (VOCs) compliant.

D. Releasable Adhesive: 3M Company, Blue Glue Multi-Purpose Carpet Adhesive or approved equivalent. Include primer if required.

E. Double Face Tape: Europort, Commercial Flooring Tape, Product Number 77-960 or approved equivalent.

F. Reducer Strips/Stair Edge Nosings: Mercer or approved equivalent. Color as selected from manufacturer's standards by Design Professional.

G. Carpet Protection: St. Regis "Seekure" and nonstaining tape.

H. Metal Edge/Transition Strips: Extruded aluminum finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints

Part 3 EXECUTION

3.1 EXAMINATION

A. Prior to installation, inspect subfloors, and advise Owner's Representative in writing of any condition, which will prevent proper installation. Installation of material will be interpreted as acceptance of subfloors as proper to receive Work.

B. Prior to installation, inspect carpet for manufacturing defects and visible color variation. Do not install defective carpet.

C. Examine carpet tile for type, color, pattern, and potential defects.

3.2 PREPARATION

A. Vacuum clean subfloors prior to installation of any material. Remove all substances detrimental to installation.

1. Make floors level and free of irregularities. Fill depressions, cracks and joints with trowel-applied leveling compound. Correct changes in floor height by troweling on leveling compound to create a ramp-like effect. Slope ramps at not to exceed 1:50. (1/4 inch per foot).

B. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.

3.3 GENERAL WORKMANSHIP REQUIREMENTS

A. Install carpet under open bottom items such as convectors and against door thresholds.

B. Install carpet tightly against all permanent vertical surfaces so that all portions of floor areas to receive carpet are covered.

C. Where removable items such as door stops, telephone or electrical outlets are present, remove them prior to installing carpet and replace them in their original location after carpet has been installed.

D. Where carpet meets other finished floor materials that are higher or lower than top surface of carpet, provide a dark anodized alum-reducing strip of appropriate size and profile to effect a smooth transition between the two (2) surfaces. Use full-length pieces only. Butt reducer strips tight to vertical surfaces. Where splicing cannot be avoided, butt ends tight and flush.

E. Where carpet meets other finished floors at same top elevation as carpet, finish carpet with no exposed edging.

F. Entire installation shall be tight and flat to sub-floor, well fastened at edges, and present a uniform appearance, free from stain, dirt, tears, frayed or pulled tufts. There shall be a monolithic match of color, pattern and texture within any one (1) area.

3.4 INSTALLATION

A. Comply with CRI 104 and carpet manufacturer's written installation instructions.

B. Install carpet tiles in a quarter turn method unless otherwise noted in documents.

C. Establish grid using standard tile laying methods and chalk lines.

D. Arrange installation so that no less than one-half tile occurs, except where design requires otherwise.

E. Joints shall be tightly butted and carefully aligned.

F. Contact Cement: Apply contact cement to all surfaces receiving carpet in the following locations.

1. Perimeter tiles 6 inches or less in width at walls and other contiguous projections.

2. Carpet Base.

G. Installation 100 percent Glue-Down: (Releasable Adhesive): Using floor sealer, seal surfaces receiving adhesive. Provide 100 percent adhesive coverage.

H. To accommodate installation, perimeter border dimensions may be adjusted up to 3 inches. If greater adjustment is required, obtain approval from Owner's Representative.

3.5 PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.

2. Remove yarns that protrude from carpet tile surface.

3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI's "Carpet Installation Standard," Section 20, "Protecting Indoor Installations."

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

D. Apply carpet protection over traffic lanes. Securely tape covering in place and maintain covering in good condition until Date of Substantial Completion. Upon acceptance of Work remove protective coverings from Project Site.

END OF SECTION 096813

SECTION 097200 WALL COVERINGS

Part 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Applicable Sections: Division 1.

C. Gypsum Wallboard Assemblies: Division 9.

D. Finish Legend: See Drawings.

1.2 SUMMARY (NON-INCLUSIVE)

A. Section Includes: Wall covering materials with accessories complete as specified herein and indicated on Drawings. Included are the following:

1. Custom vinyl graphic wallcovering by Designtex.

1.3 SUBMITTALS

A. Submit for record purposes only per the requirements of Division 1.

B. Product Data: For wall covering installation and maintenance.

C. Samples: Two (2) Samples 12 inches by 12 inches of each type and color of wall covering material from same production run to be used for the Work

D. Closeout Submittals:

1. Maintenance Data: As indicated.

2. Warranty: As indicated.

1.4 QUALITY ASSURANCE

A. Installer shall be familiar with limitations and criteria which establish an overall level of quality for workmanship using these products.

1.5 DELIVERY, HANDLING AND STORAGE

A. Comply with manufacturer's written instructions and recommendations and as herein specified.

B. Deliver materials to Project Site in original packages or containers clearly labeled to identify manufacturer, brand name, quality or grade, and fire hazard classification.

C. Store materials in original undamaged packages or containers. Do not store wall-covering fabric in an upright position. Maintain temperature in storage area above 50 degrees F.

D. Materials shall be allowed to "climatize" for at least 24 hours at a minimum temperature of 65 degrees F but not exceeding 85 degrees F prior to beginning installation.

1.6 FIELD CONDITIONS

A. Environmental Requirements: Do not install wall coverings until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating. Installation areas shall have a constant minimum temperature of not less than 65 degrees for at least 72 hours prior to beginning installation.

B. Wall temperature during installation shall be at least 65 degrees F and shall not exceed 85 degrees F.

C. Relative Humidity shall not exceed 80 percent.

D. Do not expose walls to direct sunlight during or after installation.

E. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.

1.7 MAINTENANCE DATA

A. Maintenance Data: Include maintenance manuals, procedures, recommended maintenance materials, procedures for stain removal, repairing surface, and suggested schedule for cleaning.

1.8 WARRANTY

A. Wall covering (material and labor) shall be Warranted for a period of three (3) year from Date of Substantial Completion.

1.9 MAINTENANCE

A. Extra Materials: Deliver to Owner Owner's Representative extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with requirements of Division 1.

1. Quantity: Furnish quantity of each type and color of wall covering equal to 5 percent of amount installed.
2. Delivery, Storage and Protection: Comply with Owner's Representative's requirements for delivery, storage and protection of extra materials.

Part 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Products as specified in the documents finish schedule are specified to establish desired quality and performance of Work. Other approved manufacturer's will be considered as substitutions in accordance with Division 1.

2.2 MATERIALS.

A. Do not use products or adhesives that contain urea-formaldehyde resin.

B. Wall Covering:

1. Refer to Finish Legend on Drawings for Wall Covering Schedule.
2. Product to be removable without damage to susbstrate.
3. Custom graphic of wallcovering to be determined.

C. Adhesives: Mildew resistant, non-staining, removable type as recommended in writing by wall covering manufacturer for particular substrate being covered and properly coordinated with wall covering materials.

D. Primers: Mildew resistant type complying with requirements in Division 9 and as recommended in writing by wall covering manufacturer for particular substrate being primed and properly coordinated with wall covering materials.

Part 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for levelness, wall plumbness, maximum moisture content, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected

C. Acceptance: Commencing Work constitutes acceptance of substrate. Future work or re-work required because of deficient substrates will be performed at no expense to the Owner.

3.2 PREPARATION

A. Prime and seal substrates in accordance with wall covering manufacturer's written recommendations. Surfaces shall be dry and smooth.

B. Clean substrates of substances that could impair bond of wall covering, including dirt, oil, grease, mold, mildew, and incompatible primers.

C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.

D. Maintain a constant minimum temperature of not less than 60 degrees F at areas of installation for 72 hours before, and 48 hours after application of materials.

3.3 INSTALLATION

A. Install material in compliance with manufacturer's written instructions. Unless special patterns are indicated, seams shall be vertical and at least 6 inches from any corner. Horizontal seams are not acceptable, unless indicated by special pattern. Work shall be neatly and closely fitted and trimmed throughout, leaving no open seams, rough or uneven edges.

B. Cut wall-covering strips in roll number sequence. Change the roll numbers at partition breaks and corners.

C. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without overlaps or gaps between strips.

D. Completed Work shall be free from buckles, blisters, wrinkles, loose edges, open seams, stains, soiling or imperfections of material or workmanship.

E. Remove all traces of excess adhesive.

3.4 CLEANING

A. Remove excess adhesive at seams, perimeter edges, and adjacent surfaces.

B. Use cleaning methods recommended in writing by wall-covering manufacturer.

C. Replace strips that cannot be cleaned.

D. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

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END OF SECTION 097200

SECTION 099123 PAINTING

Part 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Applicable Sections: Division 1.

C. Fluoropolymer Coatings: Division 5.

D. Structural Steel Framing: Division 5.

E. Finish Legend: See Drawings.

F. Mechanical and Electrical: Divisions 23 and 26, refer to for Sections requiring Work of this Section.

1.2 SUMMARY (NON-INCLUSIVE)

A. Section Includes: Surface preparation and field application of paints on interior surfaces throughout Project, except as specified herein. Also includes the following:

1. Coating of exposed-to-view Mechanical and Electrical work as specified herein.

1.3 SUBMITTALS

A. Submit per the requirements of Division 1.

B. Product Data: For each coat of each coating system specified.

1. Painting Schedule: Schedule listing surface preparation, between coat preparation and selected products for each coat for each substrate and system required.

2. Manufacturer's technical information, including label analysis and instructions for handling, storing and applying each material proposed for use.

3. List of each material and cross-reference specific coating, finish system, application, and location. Identify each material by manufacturer's catalog number and general classification.

4. For products not specifically listed in Part 3:

a. Manufacturer's pre-printed description of product line indicating ranking of submitted materials within product line or manufacturer's certification that materials submitted are best quality materials available from manufacturer.

C. Samples:

1. For Initial Color Selection: In form of manufacturer's color charts. After color selection, Design Professional will furnish color chips for surfaces to be coated.

2. Samples for Verification Purposes: Of each color and material to be applied, with texture to simulate actual conditions, on representative Samples of actual substrate.

a. Stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
b. List of material and application for each coat of each Sample. Label each Sample as to location and application.
c. Samples on the following substrates for Design Professional's review of color and texture only:
   1) Ferrous Metal: Two 4 inch square Samples of flat metal and two 8 inch long Samples of solid metal for each color and finish.
   2) Non-Ferrous Metal: Two 4 inch square Samples of flat metal and two 8 inch long Samples of solid metal for each color and finish.
   3) Gypsum Wallboard: Two 12 inch square Samples of each color and finish.

D. Qualifications: Manufacturer and Installer.

E. Certifications: By manufacturer that products supplied comply with local regulations controlling use of Volatile Organic Compounds (VOCs).

F. Product data for paints and coatings indicating VOC content and chemical composition.

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1.4 DEFINITIONS

A. Architectural Spaces: Corridors, rooms, closets, stairways and other spaces not specifically defined as utility spaces.

B. Coat: Individual applications of a film of paint at manufacturer's written recommended Minimum Wet Film (MWF) allowed to dry before a new film is applied.

C. Concealed: Concealed from view in Finished Work.

D. Exposed: Exposed to view in Finished Work.

E. Exterior: Exposed to the exterior atmosphere. Finished areas covered by roofs, but exposed to outside atmosphere, shall be considered an exterior area.

F. Finish Coat: Final coat of system.

G. Interior: Not exposed to exterior atmosphere.

H. MDF, MWF: Minimum Dry Film (MDF) thickness or Minimum Wet Film (MWF) thickness as recommended in writing by manufacturer.

I. MPI: Master Painters Institute.

J. Paint or Painting: A decorative, protective, or otherwise functional film applied to a substrate which may be another paint. It includes a complete system of, for example, surface preparation, primers, barrier coats, undercoats, finish coats, sanding and cleaning as specified herein for surface indicated. Paint is not for severe conditions.

K. Semi-Exposed or Semi-Concealed: Surfaces not visible from any normal seated or standing eye levels but visible from higher or lower eye levels or visible at certain times. (For example, inside of access doors; cupboard interiors; drawer interiors; shelf undersides lower than 0 inches above floor; attic and loft spaces with accessways for regular maintenance and counter undersides on non-public side).

L. Shop Primed: Primer coat applied at shop or fabricator's plant.

M. SSPC: Steel Structures Painting Council.

N. Utility Spaces: Mechanical equipment rooms, rooms scheduled as "unpainted", and spaces intended only for access by building maintenance personnel.

1.5 COLORS

A. Provide colors indicated. For surfaces not indicated, color shall be selected by Design Professional.

B. Color Scheme:

1. For majority of wall surfaces, one light color shall be specified.
2. Not more than 2 accent colors will be specified for approximately 40 percent of wall area.
3. Hollow metal doors and frames shall be painted same color.

C. A designated color shall be required in one or more types and sheens of paint, depending upon paint system specified for each specific surface.

D. Matching colors shall be exact. Do not consider that standard color line of a manufacturer to nearest shade shall be acceptable, even in small scope work.

E. Schedule

1. Refer to Finish Legend on Drawings for Paint Schedule.

1.6 SHEEN

A. Provide sheens indicated. For surfaces not indicated, sheen shall be selected by Design Professional.

B. Paint gloss shall be defined as the sheen rating of applied paint, in accordance with ASTM D 523:

1. Flat finish: 0 to 5 units at 60 degrees, maximum 15 units at 85 degrees.
2. Eggshell finish: 5 to 20 units at 60 degrees.
3. Satin finish: 15 to 35 units at 60 degrees.
4. Semi-Gloss finish: 30 to 65 units at 60 degrees.

1.7 SAMPLE PAINTING WORK

A. Provide Sample Painting Work in field on select surfaces as agreed with Owner's Representative and Contractor for each major painting system. Painting work shall be in conformance with approved Samples. Finish one complete surface of approximately 100 square feet of each color scheme required, clearly indicating selected colors, finish texture, materials and workmanship. Adjust tint, sheen and colors as directed. Do not proceed with field painting until Sample Painting Work is approved. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.

a. Other Items: Architect will designate items or areas required.

1. Final approval of color selections will be based on mockups.

a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

B. When approved, Sample Area shall serve as a minimum standard for Work throughout building.

C. Upon completion of Work, restore Sample painted surfaces to new condition.

1.8 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Company specializing in manufacture of products specified in this Section with minimum five years' experience.

B. Applicator's Qualifications: Company specializing in performing Work of this Section with minimum five years' experience.

C. Product Quality:

1. Materials shall be of one brand when possible. In any case, primers, fillers and sealers shall be same brand as finish coats. Where necessary to thin a product, use manufacturer's written recommended thinner.

2. Materials shall be manufacturer's best quality product available for each type of material. Best quality product shall be selected from manufacturer's complete product offering, irregardless of marketing descriptions, for example, Contractor's Grade, Professional Grade and Specification Grade. Economy quality is satisfactory for painting temporary structures.

3. Materials shall comply with Contract Documents, codes, and local restrictions. Where a conflict occurs between Contract Documents and codes and local restrictions, more stringent requirement shall govern.

1.9 DELIVERY, HANDLING AND STORAGE

A. Deliver paint materials in sealed original labeled containers, bearing manufacturer's name, type of paint, brand name, color designation and instructions for mixing and/or reducing.

B. Provide adequate storage facilities. Store paint materials at minimum ambient temperature of 45 degrees F in well ventilated area.

1. Maintain containers in clean condition, free of foreign materials and residue.

2. Remove rags and waste from storage areas daily.

1.10 FIELD CONDITIONS

A. Environmental Requirements: During application of paint, except as paint manufacturer's label instructions recommend otherwise, wet trade work shall be completed and dried out. Surfaces shall be dried using natural or forced ventilation, 60 degrees F or higher, maximum 85 percent Relative Humidity.

B. Do not apply paint or finishes in areas where dust is being generated.

C. If permanent lighting system is not functional, provide temporary lighting equivalent to permanent lighting system to illuminate surfaces being worked on.

1.11 COORDINATION

A. Provide finish coats which are compatible with prime paints used.

B. Where necessary, provide block, barrier or intermediate coats over incompatible primers, paints or coatings.

C. Notify Design Professional in writing of anticipated problems when using specified paints or coatings with substrates primed by Work specified in other Sections.

D. Schedule Work to minimize future Work in finish painted spaces and to allow for installation of Work that is not to be field painted, for example, sealants, hardware and pre-finished accessories.

1.12 MAINTENANCE

A. Extra Materials: Deliver to Owner's Representative, at storage location on Project Site as directed, extra materials of each paint product furnished.

1. Provide minimum two percent of each primer, intermediate and other non-finish coat products.
2. Provide minimum five percent of each color and type of finish coat.
3. Extra materials shall be in tightly sealed, manufacturer's original containers complete with original label. Indicate color and application (for example, office walls, doors or toilets) on each container.

Part 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Provide recycled content materials in accordance with Sustainability Action Plan specified in Sustainability Requirements: Division 1.

B. Provide regional materials in accordance with Sustainability Action Plan specified in Sustainability Requirements: Division 1.

C. Use paints and coatings that comply with the VOC limits and chemical restrictions specified in Sustainability Requirements: Division 1.

2.2 MANUFACTURER

A. Approved Manufacturers: Products of the following manufacturers are listed in Schedule at end of this Section to establish desired quality and performance of Work:

1. Benjamin Moore and Company (BM).
2. PPG Industries, Pittsburgh Paints (PPG).
3. Sherwin-Williams (SW).

B. Using MPI Listing as a requirement for substitutions can simplify the substitution review process. Note, however, that MPI listing is not a quality requirement of this specification, and not all named products in the schedules in Part 3 are listed by MPI.

C. Equivalent products by the following listed manufacturers are acceptable subject to compliance with specified criteria. Equivalent products of other manufacturers shall comply with specified criteria and be listed on the MPI 'Green' Approved Products List in accordance with requirements of Division 1.

1. Duron Paints.
2. ICI: Devoe, Fuller O'Brien, Glidden.

Part 3 EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be painted prior to commencement of Work. Do not paint surfaces which are not suitable. Surface to receive paint shall be clean, tight-coated and free of defects that will telegraph through paint system. Unsuitable surfaces include, but not limited to, the following:

1. Damaged surfaces (for example, nicks, dents, gouges, holes in gypsum wallboard, plaster, steel doors and frames, and similar conditions).
2. Oily, greasy, dusty or soiled surfaces.

3. Non-dressed welds which will be exposed to view.
4. Lack of touch-up where specified in other Sections.
5. Deteriorated shop-primed surfaces.
6. Rusted surfaces, unless approved in writing as acceptable by coating manufacturer.
7. Work with loose or missing items, unless specified to be painted separately.

B. Review other Sections in which primers are provided to ensure compatibility of total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers. Notify Design Professional regarding anticipated problems using the indicated materials over substrates primed by Work specified in other Sections.

C. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces below are the following maximums:

1. Concrete, Concrete Unit Masonry, and Clay Masonry: 12 percent.
2. Metal: Non-condensing.
3. Wood: 15 percent, measured in accordance with ASTM D 2016.
4. Plaster and Gypsum Wallboard: 12 percent.

D. Notify Contractor in writing of improper materials, incompatible substrates for specified system, workmanship or other defects which shall affect satisfactory execution and permanency of Work. Absence of such notification will be construed as acceptance of surfaces. Later claims of defects in surfaces shall not relieve Contractor from responsibility for performing Work.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PROTECTION

A. Protect other surfaces from paint and damage. Provide drop cloths, shields and protective equipment to prevent spray or droppings from fouling surfaces not being painted.

B. Handle scaffolding, ladders and products carefully to prevent damage to finished surfaces.

C. Post WET PAINT signs and close off newly coated areas where possible. Remove signs when Work has dried.

D. Remove electrical plates, surface hardware, fittings and fastenings, prior to painting operations. Store items and reinstall upon completion of coating work in each area.

3.3 SURFACES NOT TO BE FIELD PAINTED

A. Areas scheduled "unpainted", except for specific elements in unpainted areas which are specifically indicated for paint.

B. Exposed concrete, unless otherwise indicated.

C. Stainless steel, bronze, aluminum, copper or other prefinished metal, unless otherwise indicated.

D. Structural Steel.

E. Plastic surfaces.

F. Sealants of types which should not be painted over.

G. Rating labels on doors and frames (Mask off).

H. Wood doors, unless otherwise indicated.

I. Finish Hardware, except hardware that is factory primed.

J. Acoustical ceiling work including metal grid work, except adjacent primed metal work.

K. Gypsum wallboard and plaster scheduled to receive wall covering.

L. Sprinkler heads.

M. Piping, conduits and ducts exposed in utility spaces.

N. Valves and controls.

O. Interior surfaces of exposed to view air ducts, plenums and other similar surfaces.

P. Hot pipes and stacks.

Q. Operating parts of machinery and equipment.

R. Name and identification plates on equipment (Mask off).

S. Work furnished with complete factory finish, unless otherwise indicated.

T. Surfaces with integral finish such as glass, tile and flooring, unless otherwise indicated.

3.4 ARCHITECTURAL SURFACES TO BE FIELD PAINTED

A. Except for special coatings or finishes indicated elsewhere and "Surfaces Not to be Field Painted" listed above, field paint the following:

1. Exposed and semi-exposed interior surfaces.
2. Wall or ceiling surfaces in a space indicated on Finish Schedule to be painted, whether substrate material is listed in Schedule or not.
3. Factory primed hardware items indicated in Finish Hardware: Division 8.

3.5 MECHANICAL AND ELECTRICAL SURFACES TO BE PAINTED

A. Field paint factory primed items including switch plates and receptacle plates, grilles, diffusers, registers, frames, exposed access doors and electrical panel covers and frames, and similar items. Where removable, remove this work during undercoating work, reinstall them and paint them out in final coat work.

B. Paint primed or factory finished or otherwise pre-finished grilles, diffusers, registers, covers, trim, light fixture, and access panels for mechanical and electrical systems located in non-prefinished walls and ceilings to match surrounding surface.

C. When exposed in architectural spaces, prime and paint insulated and bare pipes, conduits, electrical boxes, and insulated or bare ducts, including hangers, brackets, collars and supports, except where items are plated or covered with a pre-finished coating, unless otherwise indicated.

D. Paint interior surfaces of air ducts, plenums, and other similar surfaces visible through interior or exterior grilles and louvers with one coat of flat black paint, to extent of visible surfaces. Paint dampers exposed behind louvers, grilles, to match face panels.

3.6 STRUCTURAL STEEL SURFACES TO BE PAINTED

A. Shop prime and finish paint all structural steel components to be fully exposed or partially exposed in finish construction including structural shapes and all related plates, angles, connections, etc. All exposed connections of structural components that will be exposed in finish construction to be field painted to match all shop painted steel. Refer to Section 099600 “High Performance Coating”.

3.7 MIXING

A. Paint products shall be factory-mixed and ready for application upon delivery.

B. Do not thin products except as specified, and except where label instructions require thinning. Follow manufacturer's written recommendations and instructions accurately.

3.8 SURFACE PREPARATION

A. Prepare and clean substrates according to paint manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Provide primers and barrier coats recommended in writing by manufacturer, but not listed in Schedule.

C. Remove hardware, faceplates, and similar items before painting, and carefully reinstall them when painting work is completed. Mask along edges of items which cannot be removed.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

D. Refine minor defects in substrates and factory primed surfaces by light sanding, wire-brushing, soft-brushing, solvent cleaning, dry wiping, and similar methods appropriate to substrates and subsequent finish. Do not use steel wool.

E. Concrete Floors: Remove contamination, acid etch, and rinse floors with clear water. Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions. Allow to dry.

F. Uncoated Steel and Iron Surfaces: Remove grease, mill scale, weld splatter, dirt and rust from steel and iron surfaces in accordance with SSPC-SP 1. Where heavy coatings of scale are evident, remove by wire brushing or other hand tools in accordance with SSPC-SP 2 or any other approved SSPC-SP method. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint after repairs.

G. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Spot prime bare steel surfaces. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

H. Galvanized Surfaces: Solvent clean to remove oils and dirt in accordance with SSPC-SP 1. Remove white rust by hand or power brushing. Remove chromate passivated treatments. Apply primer immediately after preparing Work.

I. Aluminum Surfaces: Remove surface contamination by steam or high-pressure water. Remove oxidation with acid etch and solvent washing. Apply primer immediately following cleaning.

J. Wood: Wipe off dust and grit prior to priming.

1. Scrape and clean knots and apply coat of knot sealer before applying primer.

2. Sand surfaces that will be exposed to view and dust off.

3. Prime edges, ends, faces, undersides, and backsides of wood.

4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

K. Provide masking when necessary to achieve a neat finish painting edge next to dissimilar surfaces. Remove masking carefully when paint has dried.

3.9 APPLICATION OF PAINTS

A. Verify compatibility of each type of finish coat with shop primers and between field coats.

B. Apply each coat of painting system as scheduled.

C. Apply coating only to clean, dry, smooth surfaces.

D. Apply paints according to manufacturer's label instructions, using types of brushes, rollers, or equipment as applicable to type of paint applied. Comply with coverage rates and film thicknesses of such written instructions.

E. Apply paint in proper consistency and quantity so it flows out to a level surface free of brush and roller marks, bubbles, dust, splatter, drips, runs, sags, or holidays. Spread paint evenly with uniform color, texture and sheen. Do not smear, splatter or run coatings over adjoining colors or materials. Cut-in lines shall be straight. Blend in brush painted cut-in areas on walls at, for example, ceilings, window and door jambs to provide uniform, evenly coated appearance on all surfaces.

F. Allow applied coat to dry before next coat is applied.

G. Tint each coat slightly off the preceding coat as a color indication to assure coverage of each coat.

H. Prime woodwork on six sides before installation.

3.10 FIELD QUALITY CONTROL

A. Have available at Project Site, a magnetic dry-film thickness gauge, a wet film thickness gauge, thermometer to measure surface (not ambient) temperatures, a hand lens with magnification to 25X, and device to test alkali content in surfaces. Use these devices for spot-checking quality and uniformity of paint coats and surface conditions, routinely and make available when requested by Owner's Representative or Contractor.

B. Owner reserves right to invoke the following testing procedure at any time during period when paint is being applied:

1. Owner may engage services of an independent Testing Agency to Sample paint material being used. Samples of material delivered to Project Site will be taken, identified, sealed, and certified in presence of Contractor.

2. Testing Agency shall perform appropriate tests for the following characteristics as required by Owner:

    a. Quantitative materials analysis.
    b. Abrasion resistance.
    c. Apparent reflectivity.
    d. Flexibility.
    e. Washability.
    f. Absorption.
    g. Accelerated weathering.
    h. Dry opacity.
    i. Accelerated yellowness.
    j. Skinning.
    k. Color retention.
    l. Alkali and mildew resistance.

3. If test results show material being used does not comply with specified requirements, Contractor shall be directed to stop painting, remove noncomplying materials, pay for testing and retesting, repaint surfaces coated with rejected paint, and remove rejected paint from previously painted surfaces when rejected paint and specified paint are incompatible or in any way compromise quality of specified paint system.

3.11 CLEANING, TOUCH-UP, AND REPAIR

A. As Work proceeds and upon completion, promptly remove paint where over sprayed, spilled, splashed or splattered.

B. During progress of Work, keep premises free from unnecessary accumulation of tools, equipment, temporary protection, surplus materials and debris.

C. Touch-up minor blemishes and skips in paint in preparation for initial inspection. Perform other corrections and repainting required by inspection.

D. Remove masking and other temporary protection.

E. Repair or replace Work damaged as a result of inadequate or unsuitable protection.

3.12 INTERIOR INSTITUTIONAL LOW-ODOR/VOC LATEX SCHEDULE

A. Primer for Steel Substrates:

1. BM: M04 Acrylic Metal Primer.
2. Duron: DuraClad 62 Universal Acrylic Metal Primer.
3. PPG: Pitt-Tech Plus DTM 90-912.
4. SW: ProCryl Universal Primer, B66-310.

B. Primer for Galvanized-Metal and Aluminum (Not Anodized or Otherwise Coated) Substrates:

1. BM: M04 Acrylic Metal Primer.
2. Duron: DuraClad 62 Universal Acrylic Metal Primer.
3. PPG: Pitt-Tech Plus DTM, 90-912.
4. SW: ProCryl Universal Primer, B66-310.

C. Primer for Gypsum Board and Plaster Substrates:

1. BM: Pristine Eco Spec Interior Latex Primer Sealer, 231.
2. Duron: Terminator 2 Water-Based Stain Killer.
3. PPG: Pure Performance Interior Latex Primer, 9-900.
4. SW: ProGreen Primer, B28W600.
5. MAB: EnviroPure Latex Primer.

D. Top Coats: Two coats of institutional low-odor/VOC interior latex:

	Flat	Eggshell	Semigloss
1. BM:	Eco Spec Interior Latex Flat 219	Eco Spec Interior Latex Eggshell Enamel 223	Eco Spec Interior Latex Semi-Gloss Enamel 224
2. Duron:	Genesis Acrylic flat, 60	Genesis Eggshell, 79	Genesis Semi-gloss, 83
3. PPG:	Pure Performance Interior Flat Latex 9-100	Pure Performance Interior Eggshell Latex 9-300	Pure Performance Interior Semi-Gloss Latex 9-500
4. SW:	Harmony Interior Latex Flat B5	Harmony Interior Latex Eg-Shel B9	Harmony Interior Latex Semi-Gloss B10

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END OF SECTION 099123

SECTION 099600 HIGH- PERFORMANCE COATINGS

Part 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Applicable Sections: Division 1.

C. Structural Steel: Division 5

D. Painting: Division 9.

1.2 SUMMARY (NON-INCLUSIVE)

A. Section Includes: Surface preparation and field application of high-performance coatings, including, but not limited to, the following:

1. Exterior surfaces.
    a) Concrete surfaces.
    b) Fiber-cement board.
    c) Clay masonry.
    d) Concrete masonry units (CMUs).
    e) Steel.
    f) Galvanized metal.
    g) Aluminum (not anodized or otherwise coated).
    h) Copper.
    i) Stainless steel.
    j) Wood.
    k) Fiberglass.
    l) Portland cement plaster (stucco).

2) Interior Substrates:
    a) Concrete surfaces.
    b) Cement board.
    c) Clay masonry.
    d) Concrete masonry units (CMUs).
    e) Steel.
    f) Galvanized metal.
    g) Aluminum (not anodized or otherwise coated).
    h) Wood.
    i) Fiberglass.

j) Gypsum board.

k) Plaster.

1.3 SUBMITTALS

A. Submit per the requirements of Division 1.

B. Product Data: For each coating system specified.

1. Coating Schedule: Schedule listing surface preparation, between coat preparation and selected products for each coat for each substrate and system required.

2. Manufacturer's technical information, including label analysis and instructions for handling, storing and applying each material proposed for use.

3. List of each material and cross-reference specific coating, finish system, application, and location. Identify each material by manufacturer's catalog number and general classification.

C. Samples:

1. For Initial Color approval: Color chips to match design professional sample.

2. Samples for Verification Purposes: Of each color and material to be applied, with texture to simulate actual conditions, on representative Samples of actual substrate.

a. Stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
b. List of material and application for each coat of each Sample. Label each Sample as to location and application.
c. Samples on the following substrates for Design Professional's review of color and texture only:

1) Ferrous Metal: Two 4 inch square Samples of flat metal and two 8 inch long Samples of solid metal for each color and finish.

2) Non-Ferrous Metal: Two 4 inch square Samples of flat metal and two 8 inch long Samples of solid metal for each color and finish.

3) Gypsum Wallboard: Two 12 inch square Samples of each color and finish.

D. Qualifications: Manufacturer and Installer.

E. Certifications: By manufacturer that products supplied comply with local regulations controlling use of Volatile Organic Compounds (VOCs).

F. Sustainability Submittals:

1. Product data for paints and coatings indicating VOC content and chemical composition.

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1.4 DEFINITIONS

A. Architectural Spaces: Corridors, rooms, closets, stairways and other spaces not defined as utility spaces.

B. Coat: Individual application of a film of high-performance coating at manufacturers Minimum Wet Film (MWF) thickness and allowed to dry before a new film is applied.

C. Coating: A highly protective, decorative or otherwise functional high-performance film applied to a substrate. Coatings shall mean a complete system of, for example, surface preparation, primers, barrier coats, undercoats, finish coats, sanding and cleaning as specified herein for surfaces indicated.

D. Concealed: Concealed from view in Finished Work.

E. Epoxy Paint: High performance coating system as specified herein.

F. Exposed: Exposed to view in Finished Work.

G. Exterior: Exposed to the exterior atmosphere. Finished areas covered by roofs, but exposed to outside atmosphere, shall be considered an exterior area.

H. Finish Coat: Final coat of system.

I. Interior: Not exposed to exterior atmosphere.

J. MDF-MWF: Minimum Dry Film (MDF) thickness or Minimum Wet Film (MWF) thickness as recommended in writing by manufacturer.

K. Paint or Painting: Coating system in accordance with Painting: Division 9.

L. Semi-Exposed or Semi-Concealed: Surfaces not visible from any normal seated or standing eye levels but visible from higher or lower eye levels or visible at certain times. (For example, inside of access doors; cupboard interiors; drawer interiors; shelf undersides lower than [30 inches] {750 mm} above floor; attic and loft spaces with accessways for regular maintenance and counter undersides on non-public side).

M. Shop Primed: Primer coat applied at shop or fabricator's plant.

N. SSPC: Steel Structures Painting Council.

O. Utility Spaces: Mechanical equipment rooms, rooms scheduled as "unpainted" or "uncoated", and spaces accessible only to building maintenance personnel.

1.5 COLORS

A. Contractor will match Design Professional's sample for each color indicated..

B. Manufacturer's Qualifications: Company specializing in manufacture of products specified in this Section with minimum five years' experience.

C. Applicator's Qualifications: Company specializing in performing Work of this Section with minimum five years' experience.

D. Product Quality:

1. Materials shall be of one brand when possible. In any case, primers, fillers and sealers shall be same brand as finish coats. Where necessary to thin a product, use manufacturer's written recommended thinner.

2. Materials shall be manufacturer's best quality product available for each type of material. Best quality product shall be selected from manufacturer's complete product offering, irregardless of marketing descriptions, for example, Contractor's Grade, Professional Grade and Specification Grade. Economy quality is satisfactory for coating temporary structures.

3. Materials shall comply with Contract Documents, codes, and local restrictions. Where a conflict occurs between Contract Documents and codes and local restrictions, more stringent requirement shall govern.

1.6 DELIVERY, HANDLING AND STORAGE

A. Deliver coating materials in sealed original labeled containers, bearing manufacturer's name, type of coating, brand name, color designation and instructions for mixing or reducing.

B. Provide adequate storage facilities. Store coating materials at minimum ambient temperature of 45 degrees F in well ventilated area.

1. Maintain containers in clean condition, free of foreign materials and residue.

2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Environmental Requirements: During application of coating, except as coating manufacturer's label instructions recommend otherwise, wet trade work shall be completed and dried out. Surfaces shall be dried using natural or forced ventilation, 60 degrees F or higher, maximum 85 percent Relative Humidity.

B. Do not apply coatings in areas where dust is being generated.

C. If permanent lighting system is not functional, provide temporary lighting equivalent to permanent lighting system to illuminate surfaces being worked on.

D. Do not apply exterior coatings in snow, rain, fog, or mist.

1.8 COORDINATION

A. Provide finish coats that are compatible with primers used.

B. Where required, provide block, barrier or intermediate coats over incompatible primers, paints or coatings.

C. Notify Design Professional in writing regarding anticipated problems when using specified coatings with substrates primed by other than this Installer.

D. Schedule Work to minimize future Work in finish coated spaces and to allow for installation of Work that is not to be field coated, including, sealants, hardware, pre-finished accessories, and similar items.

E. Coordinate with work of Division 5 where shop priming and finish painting is required.

1.9 MAINTENANCE

A. Extra Materials: Deliver to Owner's Representative, at storage location on Project Site as directed, extra materials of each coating product furnished.

1. Provide minimum two percent of each primer, intermediate and other non-finish coat products.
2. Provide minimum five percent of each color and type of finish coat.
3. Extra materials shall be in tightly sealed, manufacturer's original containers complete with original label. Indicate color and application (for example, office walls, doors or bathrooms) on each container.

Part 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Provide regional materials in accordance with Sustainability Action Plan specified in Sustainability Requirements: Division 1.

B. Use paints and coatings that comply with the VOC limits specified in Sustainability Requirements: Division 1. Where indicated, the chemical restrictions do not apply to this section.

C. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

D. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

3. Products shall be of same manufacturer for each coat in a coating system.

2.2 MANUFACTURER

A. Approved Manufacturers: Products of the following manufacturers are listed in Schedule at end of this Section to establish desired quality and performance of Work:

1. CAR: Carboline (RPM).

2. Akzo Nobel Paints LLC dba Glidden Professional and Devoe Coatings.

3. M.A.B. Paints (MAB).

4. PPG Industries, Pittsburgh Paints (PPG).

5. Sherwin-Williams (SW).

6. Tnemec Company (TC).

Part 3 EXECUTION

3.1 EXAMINATION OF SURFACES

A. Examine surfaces to be coated prior to commencement of Work. Do not coat surfaces that are not suitable. Surface to receive coating shall be clean, tight-coated and free of defects that will telegraph through coating system. Unsuitable surfaces include, but not limited to, the following:

1. Damaged surfaces (for example, nicks, dents, gouges, holes in gypsum wallboard, plaster, steel doors and frames, and similar conditions).

2. Oily, greasy, dusty, or soiled surfaces.

3. Non-dressed welds that will be exposed to view.

4. Lack of touch-up where specified in other Sections.

5. Deteriorated shop-primed surfaces.

6. Rusted surfaces, unless approved in writing as acceptable by coating manufacturer.

7. Work with loose or missing items, unless specified to be coated separately.

B. Review other Sections in which primers are provided to ensure compatibility of total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers. Notify Design Professional regarding anticipated problems using the indicated materials over substrates primed by Work specified in other Sections.

C. Do not apply finishes unless moisture content of surfaces is below the following maximums:

1. Metal: Non-condensing.

3.2 PROTECTION

A. Protect other surfaces from coating and damage. Provide drop cloths, shields and protective equipment to prevent spray or droppings from fouling surfaces not intended for coating.

B. Handle scaffolding, ladders and products carefully to prevent damage to finished surfaces.

C. Post WET PAINT signs and close off newly coated areas where possible. Remove signs when Work has dried.

D. Remove electrical plates, surface hardware, fittings and fastenings, prior to coating operations. Store items and reinstall upon completion of coating work in each area.

3.3 SURFACES NOT TO BE FIELD COATED

A. Areas, elements and surfaces scheduled for paint in Painting: Division 9.

B. Areas scheduled "unpainted or uncoated", except for specific elements in uncoated areas which area indicated to be coated.

C. Exposed concrete, unless otherwise indicated.

D. Face brick, glazed masonry, ground face concrete masonry units, stone or other similar masonry, unless otherwise indicated.

E. Structural Steel that will be exposed or partially exposed in finish construction.

F. Stainless steel, bronze, aluminum, copper or other pre-finished metal, unless otherwise indicated.

G. Plastic surfaces.

H. Sealants of types which should not be painted over.

I. Rating labels on doors and frames. Mask off.

J. Wood doors, unless otherwise indicated.

K. Finish hardware, except hardware that is factory primed.

L. Acoustical plaster.

M. Acoustical ceiling work including metal grid work, except adjacent primed metal work.

N. Surfaces scheduled to receive fiberglass reinforced epoxy systems.

O. Gypsum wallboard and plaster scheduled to receive wall covering.

P. Wire mesh partitions, unless otherwise indicated.

Q. Elevator cab doors and frames, unless otherwise indicated.

R. Sprinkler heads.

S. Piping, conduits and ducts exposed in utility spaces.

T. Valves and controls.

U. Interior and exterior surfaces of exposed to view air ducts, plenums and other similar surfaces.

V. Hot pipes and stacks.

W. Operating parts of machinery and equipment.

X. Name and identification plates on equipment. Mask off.

Y. Work furnished with complete factory finish, unless otherwise indicated.

Z. Surfaces with integral finish such as glass, tile and flooring, unless otherwise indicated.

3.4 SURFACES TO BE FIELD COATED

A. Except for special coatings or finishes indicated elsewhere and "Surfaces Not to be Field Coated" listed above, field coat the following:

1. Roof level surfaces and elements, unless otherwise indicated.

3.5 MIXING

A. Single component products shall be factory-mixed and ready for application upon delivery.

B. Multi-component products shall be factory pre-packaged for mixing on Project Site. Pre-packaging shall be sized to allow for mixing of proper proportions in full container units without separate measuring on Project Site.

C. Do not thin products except as indicated, and where label instructions require thinning. Follow manufacturer's written recommendations and instructions.

3.6 SURFACE PREPARATION

A. Prepare and clean substrates according to coating manufacturer's written instructions, SSPC recommendation, and as indicated, whichever is more stringent. Verify proper conditions of surfaces.

B. Provide primers and barrier coats recommended in writing by manufacturer, but not listed in Schedule.

C. Refine minor defects in substrates and factory primed surfaces by light sanding, wire-brushing, soft-brushing, solvent cleaning, dry wiping, and similar methods appropriate to substrates and subsequent finish. Do not use steel wool.

D. Lightly sand and dust-off coatings between coats or treat as recommended in writing by system manufacturer.

E. Uncoated Steel and Iron Surfaces: Remove grease, mill scale, weld splatter, dirt and rust from steel and iron surfaces in accordance with SSPC-SP 1. Where heavy coatings of scale are evident, remove by wire brushing or other hand tools in accordance with SSPC-SP 2 or any other approved SSPC-SP method. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime coat after repairs.

F. Shop Primed and Painted Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Spot prime bare steel surfaces.

G. Galvanized Surfaces: Solvent clean to remove oils and dirt in accordance with SSPC-SP 1. Remove white rust by hand or power brushing. Remove chromate passivated treatments. Apply primer immediately after preparing Work.

H. Provide masking when necessary to achieve a neat finish coating edge next to dissimilar surfaces. Remove masking carefully when coating has dried.

3.7 APPLICATION OF COATINGS

A. Verify compatibility of each type of finish coat with shop primers and between field coats.

B. Apply each coat of system as scheduled.

C. Apply coating only to clean, dry, smooth surfaces.

D. Apply coatings according to manufacturer's label instructions, using types of brushes, rollers, or equipment as applicable to type of coating applied. Comply with coverage rates and film thicknesses of such written instructions.

E. Apply coating in proper consistency and quantity so it flows out to a level surface free of brush and roller marks, bubbles, dust, splatter, drips, runs, sags or holidays. Spread coating evenly with uniform color, texture and sheen. Do not smear, splatter or run coatings over adjoining colors or materials. Cut-in lines shall be straight. Blend in brush coated cut-in areas on walls at, for example, ceilings, window and door jambs to provide uniform, evenly coated appearance on all surfaces.

F. Allow applied coat to dry before next coat is applied.

G. Tint each coat slightly off the preceding coat as a color indication to assure coverage of each coat.

H. Prime woodwork on six sides before installation.

I. Prime concealed surfaces of interior millwork.

J. Seal hardware mortises, tops, bottoms, and cut-offs of wood doors with heavy coat of varnish or similar sealer immediately upon delivery to Project Site.

3.8 FIELD QUALITY CONTROL

A. Have available at Project Site, a magnetic dry-film thickness gauge, a wet film thickness gauge, thermometer to measure surface (not ambient) temperatures, a hand lens with magnification to 25X, and device to test alkali content in surfaces. Use these devices for spot-checking quality and uniformity of coats and surface conditions, routinely and make available when requested by Owner or Design Professional.

B. Owner reserves right to invoke the following testing procedure at any time during period when coating is being applied:

1. Owner may engage services of an independent Testing Agency to sample coating material being used. Samples of material delivered to Project Site will be taken, identified, sealed and certified in presence of Contractor.

2. Testing Agency shall perform appropriate tests for the following characteristics as required by Owner:

a. Quantitative materials analysis.
b. Abrasion resistance.
c. Apparent reflectivity.
d. Flexibility.
e. Washability.
f. Absorption.
g. Accelerated yellowness.
h. Dry opacity.
i. Accelerated yellowness.
j. Recoating.
k. Skinning.
l. Color retention.
m. Alkali and mildew resistance.

3. If test results show material being used does not comply with specified requirements, Contractor shall be directed to stop coating, remove noncomplying materials, pay for testing and retesting, recoat surfaces coated with rejected coating, and remove rejected coating from previously coated surfaces when rejected coating and specified coating are incompatible or in any way compromise quality of specified coating system.

3.9 CLEANING, TOUCH-UP, REPAIR

A. As Work proceeds and upon completion, promptly remove coating where over sprayed, spilled, splashed or splattere

B. During progress of Work, keep premises free from unnecessary accumulation of tools, equipment, temporary protection, surplus materials and debris.

C. Protect work of other trades against damage from coating operation. Correct damage to work of other trades by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.

D. Touch-up minor blemishes and skips in coating in preparation for initial inspection. Perform other corrections and recoating required by inspection.

E. Remove masking and other temporary protection.

F. Repair or replace Work damaged as a result of inadequate or unsuitable protection.

3.10 EXTERIOR COATING SCHEDULE

A. Provide the following coating systems for surfaces indicated.

1. Steel Substrates (acrylic epoxy, semi-gloss, maximum 250 g/L VOC):
   a. CAR: 6-9 mil water-based epoxy acrylic gloss system.
   b. Primer: Carbocrylic 3358 MC.
   c. Top Coat: Two coats Sanitile 255 High Performance WB Epoxy Acrylic Finish.
2. Glidden Professional: 5-7 mil water-based epoxy semi-gloss system.
   a. Primer: Devoe Coatings Devran 203 Waterborne Epoxy Primer.
   b. Top Coat: Two coats Devoe Coatings Tru-Glaze-WB 4426 Waterborne Semi-Gloss Epoxy.
3. PPG: 6-10 mil acrylic epoxy water-borne semi-gloss system.
   a. Primer: Pitt-Tech Plus Int./Ext. DTM Industrial Primer, 90-912 Series.
   b. Top Coat: Two coats Pitt-Glaze WB Water-Borne Acrylic Epoxy (Semi-Gloss), 16-551.
4. SW: 5-7.4 mil acrylic epoxy satin system.
   a. Primer: Pro-Cryl Universal Primer, B66-310 Series.
   b. Top Coat: Two coats Pro Industrial Pre-Catalyzed Waterbased Epoxy Eg-Shel, K45 Series.

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END OF SECTION 099600

SECTION 101423 INTERIOR SIGNS

Part 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Finishes: Division 9.

C. Mechanical: Division 23.

D. Plumbing: Division 22.

E. Electrical: Division 26.

F. Sections of Work to which interior signage is attached or fastened to its surface.

1.2 SUMMARY (NON-INCLUSIVE)

A. Section Includes: Interior Signage, international symbol signs, floor identification signs. Provide complete, as indicated.

1.3 DEFINITIONS

A. Accessible: In accordance with the accessibility standard.

B. Illuminated: Illuminated by lighting source integrally constructed as part of the sign unit.

1.4 COORDINATION

A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

B. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

1.5 SUBMITTALS

A. Submit per the requirements of Division 1.

B. Shop Drawings: Show fabrication and installation details.

C. Samples:

1. Sign Schedule: Use same designations indicated on Drawings.
2. Provide Sample inter-letter and inter-word spacing on Sample sign inserts and panels for Owner's Representative's approval before fabrication is initiated.
    a. One (1) Sign Type "A", Room Identification Sign.
    b. One (1) Sign Type "B", International. Symbol Sign/Floor Identification Sign.

D. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.

E. Provide message list, typestyles, graphic elements, including tactile characters and Braille, and layout for each sign.

1.6 CLOSEOUT SUBMITTAL

A. Special Warranty: As indicated.

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1.7 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

C. Source Limitations for Signs: Obtain each sign type indicated from one source from a single manufacturer.

D. Regulatory Requirements: Comply with applicable provisions in ADA-ABA Accessibility Guidelines and ICC/ANSI A 117.1.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify locations of [anchorage devices] [and] [electrical service] embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.9 SPECIAL WARRANTY

A. Furnish five (5) year warranty on metal finishes, against peeling, cracking, fading, crazing or blistering.

Part 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Basis of Design: Products of ASI Sign Systems Inc., "InTac", ADA-Ready, Sign System are specified to establish desired quality and performance of Work. Equivalent products of other manufacturers will be evaluated as substitutions in accordance with requirements of Division 1.

2.2 MATERIALS

A. Aluminum Sheet and Plate: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 5005-H32.

B. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 6063-T5.

C. Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing).

D. Tactile and Braille Sign: Manufacturer's standard process for producing text and symbols complying with ADA-ABA Accessibility Guidelines and with ICC/ANSI A 117.1. Text shall be accompanied by Grade 2 Braille. Produce precisely formed characters with square-cut edges free from burrs and cut marks; Braille dots with domed or rounded shape.

1. Panel Material: Manufacturers standard.
2. Raised-Copy Thickness: Not less than 1/32 inch.

2.3 SIGNS

A. Provide sign types indicated (All signs to be reviewed and approved by Owner):

1. Sign Type A:
   a. Room Identification Sign.
2. Sign Type B:
   a. International Symbol Sign/Floor Identification Sign.
   b. International Symbol Sign/Toilet Room Identification Sign.
3. Sign Type C:
   a. Tactile Exit Signs.
4. Sign Type D:
   a. Emergency Signs.
5. Sign Type E:
   a. Equipment Room and Door Labeling.

B. Refer to Signage Specifications for sign layout, copy and mounting heights and Interior Signage.

1. Sign Types A, B, and C are to have a 1/8-inch acrylic core and a 1/16-inch clear acrylic bonded face.

C. All signage shall be ADA compliant.

2.4 WORKMANSHIP

A. Execute reverse screening of letters true and level, letter forms with rounded corners, chipped, nicked, cut or ragged edges are not acceptable. Screening to be executed in such a manner that edges and corners of finished letter forms are true and clean. Laminations shall be free of trapped air or other imperfections and edges shall be trimmed flush, so that front face appears monolithic.

B. Fabricate joints, miters, and other features with Work accurately machined, filed and fitted rigidly framed together at joints and contact points. Carefully match work to produce a perfect continuity of lines and designs, with finish materials in contact having hairline joints. Edges of sign plaques shall be smoothly finished.

C. Finishes shall be free from lines, ridges, variations in color, orange peel, bubbles, pin holes, mottling, crazing, coarse particles and grit.

D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.5 MESSAGES

A. Form:

1. Letter type style shall be Arial upper case.
2. Lettering on changeable inserts to be die cut vinyl in white as requested.
3. Copy of signs shall be indicated on Signage Specifications. If copy is not listed, vendor is to provide a blank changeable message strip.

4. International symbols will be ALGA International Symbols as approved by U.S. Department of Transportation.

B. Inter-Letter Spacing: Tight letter spacing is required.

2.6 ACCESSORIES

A. Use adhesives and sealants that comply with the VOC limits specified in Sustainability Requirements: Division 1.

B. Fastenings:

1. Foam Tape:
   a. Use pressure sensitive double-sided foam tape fastening and silicone glue.
   b. Adhesive quality to be minimum 55 ounces per inch width, after curing 24 hours.
   c. Thickness shall be determined by Contractor.
   d. Changeability: Tape adhered materials shall be capable of removal, without damage to surfaces on which applied, by means of suitable liquid remover solvent.
   e. Use additional silicone adhesive on signs to prevent theft.
2. Hang with metallic slip connector mechanically fastened to wall.
3. Mechanically fasten with concealed fasteners.
4. Secure Velcro strips to wall with adhesive supplied by Velcro manufacturer.
5. Locations:
   a. To be reviewed with owner.

Part 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

3.2 INSTALLATION

A. Erect Work plumb, level and true, with proper alignment and relationship to Work of other Sections, free of sway and deflection, structurally sound and rigidly secured.

B. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.

C. Install signs so they do not protrude or obstruct according to the accessibility standard.

D. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

E. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

3.4 MESSAGE SCHEDULE

INTERIOR SIGN SCHEDULE			
	TYPE	**DESCRIPTION**	**ESTIMATED QUANTITY**
	A.	Room Indication Sign 5 inches by 5 inches	14
	C.	Tactile Exit Signs.	2
	D.	Emergency Signs	2
	E.	Equipment Room and Door Labeling	2

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END OF SECTION 101423

SECTION 102113.16 TOILET COMPARTMENTS

Part 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Applicable Sections: Division 1.

C. Metal Fabrications: Division 5.

D. Architectural Woodwork: Division 6.

E. Toilet Accessories: Division 10.

F. Finish Legend: See Drawings.

1.2 SUMMARY (NON-INCLUSIVE)

A. Section Includes: Partitions for toilet compartments including hardware and accessories.

1.3 SUBMITTALS

A. Submit per the requirements of Division 1.

B. Shop Drawings: For fabrication and erection of toilet compartment assemblies not fully described by product drawings, templates and written instructions for installation of anchorage devices built into other work. Show supports for overhead partitions.

1. Include plans, elevations, sections, details, and attachment details.
2. Retain first subparagraph below if required or revise to suit Project.
3. Show locations of cutouts for compartment-mounted toilet accessories.
4. Show locations of centerlines of toilet fixtures.

C. Product Data: For materials, fabrication, and installation including catalog cuts of anchors, hardware, fastenings and accessories.

D. Samples: Samples of doors hardware. Finishes submit per requirements of Architectural Woodwork: Division 6.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

B. Referenced Codes and Standards: Comply with the following in accordance with Division 1.

1. American National Standards Institute (ANSI)

A 117.1	Buildings and Facilities: Providing Accessibility and Usability for Physically Handicapped People

2. The Department of Justice

Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities

1.5 DESIGN AND PERFORMANCE CRITERIA

A. Compartments shall be flush construction, with approved core material. Units shall have tight straight line joints and shall be assembled into a rigid structure that shall maintain its initial appearance indefinitely. Edges shall be sealed with a continuous oval locking strip, mitered and welded at corners.

B. Compartments for disabled shall be in compliance with ANSI A 117.1 and ADAAG for "Buildings and Facilities". Where differences exist, most stringent regulations shall apply.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

Part 2 PRODUCTS

2.1 APPROVED MANUFACTURERS OF HARDWARE

A. Products of indicated manufacturers are acceptable. Equivalent products of other manufacturers will be evaluated as substitutions in accordance with requirements of Division 1.

1. Basis of Design: Scranton Products. 800-445-5148
2. The Mills Company.
3. The Sanymetal Products Company, Inc.
4. Flush Metal Partition Corporation.
5. Metpar Steel Products Corporation.

2.2 MATERIALS

A. Doors, Panels and Pilasters:

1. High density polyethylene (HDPE), fabricated from polymer resins compounded under high pressure, forming single thickness panel.

2. Waterproof and nonabsorbent, with self-lubricating surface, resistant to marks by pens, pencils, markers, and other writing instruments.

3. Thickness: 1 inch (25 mm) with 1/4 inch (6 mm) radiused edges. One edge of pilaster and transom panels to be ship lapped.

4. Recycled Content (Post consumer): 100%

5. Fire Rating: Tested per ASTM E 84: Class A flame spread/smoke developed rating

B. Aluminum and Aluminum Extrusions: ASTM B221, 6463-T5 alloy and temper.

C. Stainless Steel: ASTM A167, Type 304.

D. Concealed Anchorage Reinforcement: Minimum 0.108 inch (12 gage), galvanized steel sheet.

E. Hardware and Accessories:

1. Hinges: Manufacturer's standard design, heavy duty operating hardware and accessories of satin stainless steel.
2. Occupancy indicator latch and housing: Stain stainless steel showing green and red occupancy indicators
3. Slide bolt and button: Satin Stainless steel.
4. Door Pulls: Satin stainless steel. Provide ADA pull and latch on ADA compartments.

F. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, chromium-plated steel, or brass, finished to match hardware, with theft-resistant-type heads and nuts. For concealed anchors, use hot-dip galvanized, cadmium-plated, or other rust-resistant protective-coated steel.

2.3 PARTITION TYPES

A. Toilet Compartments: Basis of Design – Scranton Products Aria Partitions, full height toilet cubicles, floor mounted and top supported.

2.4 FABRICATION: GENERAL

A. General: Standard doors and panels fabricated for compartment system. Units with cutouts, drilled holes, and internal reinforcement to receive partition-mounted hardware, accessories, and grab bars, as indicated.

1. Manufactured panel thickness shall allow for proper hardware and fitting installation. Panel manufacturer shall verify panel thickness with approved and purchased hardware.
2. Seal exposed core material at cutouts to protect core from moisture.

B. Door Dimensions: Unless otherwise indicated, provide 24 inchwide in-swinging doors for standard toilet stalls and 32-inch-wide, clear opening, out-swinging doors for stalls equipped for use by disabled.

2.5 FINISH

A. Color: As indicated on Drawings.

Part 3 EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.

1. Confirm location and adequacy of blocking and supports required for installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Acceptance: Commencing Work constitutes acceptance of substrate. Future work or re-work required because of deficient substrates will be performed at no expense to the Owner.

D.

3.2 INSTALLATION

A. Install Work in accordance with manufacturer's written instructions and recommendations. Drill tile or masonry as required. Finished Work shall be rigid, straight, level, plumb, free of dents, tool marks, warpage or open joints.

1. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.

2. Align brackets at pilasters with brackets at walls.

B. Adjust hardware for smooth operation. Set hinges to hold doors ajar 30 degrees when unlatched. Lubricate moving parts.

3.3 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to return doors to fully closed position when unlatched. Set hinges on out-swinging doors and doors in entrance screens to return doors to fully closed position.

3.4 CLEAN UP

A. Subject to approval by Contractor and Owner's Representative, slight imperfections may be touched up with matching colored paint supplied by compartment manufacturer. If rejected, redo touch-up work until approved, or replace with new work.

B. Upon completion of Work, remove labels or marks of identification and clean and polish finished surfaces.

END OF SECTION 102113.16

SECTION 102600 WALL AND CORNER GUARDS

Part 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Applicable Sections: Division 1.

C. Joint Sealants: Division 7, refer to for sealant around perimeter of corner guards.

D. Gypsum Wallboard Assemblies: Division 9.

1.2 SUMMARY (NON-INCLUSIVE)

A. Section Includes: Wall and corner guards complete as indicated.

1. Corner guards.
2. Fasteners and retainers.

1.3 SUBMITTALS

A. Submit per the requirements of Division 1.

B. Samples: In duplicate, of each component furnished.

C. Sustainability Submittals:

1. Product data for adhesives and sealants indicating VOC content.

Part 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Manufacturers and products indicated are acceptable. Equivalent products of other manufacturers will be evaluated as substitutions in accordance with requirements of Division 1.

2.2 STAINLESS STEEL CORNER GUARD

A. Tubular Specialties Manufacturing, Inc., Wilkinson Chutes, Inc. or Design Professional.

1. Surface mounted, 3 1/2 inchesby 3 1/2 inches, 16 gage No. 4 satin finish. Furnish corner guards with strippable paper protective covering.

2.3 ACCESSORIES

A. Sealant: Silicone sealant as specified in Joint Sealants: Division 7.

Part 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install Work in accordance with manufacturer's written instructions.

B. Install stainless steel corner guards using waterproof mastic.

C. Provide continuous sealant bead around perimeter of corner guards. Refer to Joint Sealants: Division 7.

3.3 CLEAN UP

A. Remove paper covering from stainless steel wall and corner guards during final cleaning of building.

B. Clean corner guards of dirt, smudges, streaks, and discolorations in accordance with manufacturer's written recommendations.

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END OF SECTION 102000

SECTION 102800 TOILET ACCESSORIES

Part 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Glazing: Division 8, refer to for mirrors.

C. Tile: Division 9.

D. Toilet Compartments: Division 10.

1.2 SUMMARY (NON-INCLUSIVE)

A. Section Includes: Toilet accessories complete as indicated.

1.3 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

1.4 SUBMITTALS

A. Submit per the requirements of Division 1.

B. Product Data: For each accessory for approval.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation

C. Samples: Two (2) for each type of toilet room accessory specified, complete with required trim and fastenings, for Design Professional's approval.

D. Quality Control Procedures: Schedules of Toilet Accessories showing quantity and location for each room or area.

1.5 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

1.7 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, visible silver spoilage defects.

2. Warranty Period: 5 years from date of Substantial Completion.

1.8 QUALITY ASSURANCE

A. Single-Source Responsibility: Obtain accessory items from one (1) manufacturer, unless otherwise indicated.

B. Installer's Qualifications: Not less than five (5) years documented, successful experience with Work comparable to Work of this Project.

1.9 DELIVERY, HANDLING AND STORAGE

A. Deliver accessories in carefully packed containers, each complete with required fasteners and miscellaneous devices. Handle with care. Label each container indicating type, floor and space designation, brand name of manufacturer. Mirrors shall be factory labeled and labels shall not be removed until installation has been approved.

B. Special Handling: Package each accessory separately for delivery and include complete written installation instructions, templates if required, screws, bolts, inserts and theft-proof devices, required for proper installation.

1.10 HANDICAP ACCESSORIES

A. Items shall comply with ANSI 117.1 ADA rules and regulations.

Part 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Provide recycled content materials in accordance with Sustainability Action Plan specified in Sustainability Requirements: Division 1 and as indicated below.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 APPROVED MANUFACTURERS

A. Products of Bobrick Washroom Equipment, Inc. are used to establish desired quality and performance of Work. See Drawings for types and locations.

2.3 MATERIALS

A. Construction: Cabinets and related formed metal accessories shall be of not less than 22 gage stainless steel, unless otherwise indicated. Exposed cabinet frames, flanges and the like shall be of not less than 20 gage stainless steel, cut and formed from one (1) piece. Assemblies shall be all welded construction, dressed and finished smooth on exposed surfaces. Doors shall be of not less than 20 gage stainless steel, provided with continuous

stainless-steel piano hinges. Exposed portions of accessories shall be free from manufacturer's identifying marks. Accessories in any single space shall be product of one (1) manufacturer.

B. Stainless steel shall conform to ASTM A480, ASTM 666, Type 304, No. 4 Satin Polish Finish, 0.031-inch minimum nominal thickness unless otherwise indicated

C. Sound-Deadening materials shall be 3M "EC-100" Vibrademp" No. 111 Sound Deadener" or manufacturer's standard sound deadening material. Apply sound deadening material on backs of accessories designated to be placed in a common wall, recessed in pipe spaces and on back to back accessories.

D. Chrome-plated accessories and stainless steel shall have matching finishes.

E. Inserts, Anchors and Fasteners:

1. Concealed fastenings wherever possible. Where exposed fastenings are required, match finish of fastenings to finish of accessories fastened thereby and be tamper-and-theft resistant.

2. Fasteners recommended in writing by accessory manufacturer, appropriate for proper attachment to supporting substrates.

3. Theft-resistant fasteners for exposed mountings.

F. Locking Devices: Except for vendor-type accessories, all items requiring locks shall be of same manufacturer and keyed alike. If certain items cannot be keyed with other accessories, a two-sided key may be provided: one (1) side for special keying, and other side for remaining accessories.

2.4 REQUIRED PRODUCTS

A. Refer to Toilet Accessory Schedule on Drawings for list of Products and Requirements.

2.5 FABRICATION

A. General: Fabricate units with tight seams and joints,

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

EXECUTION

2.6 COORDINATION

A. Cooperate in scheduling and coordination of Work with other Sections.

B. Templates: Furnish templates to respective trades for locations and clearances required in rough framing in connection with installation of recessed accessory fixtures. Templates for location of mounting holes (standard and metric dimensions) for toilet tissue dispensers and folding utility shelves and other accessories shall be furnished to toilet partition manufacturer.

2.7 INSTALLATION

A. Install accessories on provided wood grounds and frames for both recessed and surface mounting. Installation shall be in accordance with written instructions of product manufacturer and as approved by Owner's Representative. Anchorage in masonry shall be with expansion shields or toggles, as conditions require, and with lead plugs in tile and mortar. Wood plugs are not acceptable. Location of accessories to be used by handicapped shall be in accordance with applicable rules and regulations for handicapped.

B. Units with rough or jagged edges or corners are not acceptable.

2.8 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written instructions.

.

END OF SECTION 102800

SECTION 104416 FIRE EXTINGUISHERS AND CABINETS

Part 1 GENERAL

1.1 RELATED DOCUMENTS SPECIFIED ELSEWHERE (NON-INCLUSIVE)

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Firestopping: Division 7, refer to for firestopping at fire rated cabinets.

C. Gypsum Wallboard Assemblies: Division 9, refer to for cabinet framing and cutout.

1.2 SUMMARY (NON-INCLUSIVE)

A. Section Includes: Fire extinguishers, cabinets, fasteners and all required accessories complete as indicated.

1.3 SUBMITTALS

A. Submit for record only per the requirements of Division 1.

B. Product Data: Show construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection specialties.

1. Fire Extinguishers: Include rating and classification.
2. Cabinets: Include door hardware, cabinet type, trim style, panel style, and details of installation. Include written certification that submitted fire extinguisher cabinets will conform to required fire ratings and accommodate specified fire extinguishers.
3. Show location of knockouts for hose valves.

C. Samples: For each exposed cabinet finish.

D. Certifications: Extinguishers full and operational.

E. Sustainability Submittals: Provide the following in accordance with Sustainability Requirements: Division 1.

1. Materials Sustainability Documentation Form.
2. Product data, certification letter, and costs for materials with recycled content.
3. Product data and costs for regional materials.

1.4 COORDINATION

A. Coordinate size of cabinets to ensure that type and capacity of hoses, hose valves, and hose racks indicated are accommodated.

Part 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Agencies and Codes: Comply with Codes as referenced below.

B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Standard for Portable Fire Extinguishers."

C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent Inspection and Testing Agency acceptable to authorities having jurisdiction.

2.2 FIRE EXTINGUISHER CABINETS

A. Approved Manufacturers: Products of indicated manufacturers are acceptable. No substitutions.

1. Larsen's Manufacturing Company.
2. J. L. Industries, Inc.
3. Potter-Roemer, Inc.

B. Provide fire extinguisher cabinets for the following types of portable fire extinguishers:

1. Class BC carbon dioxide type.
2. Class ABC multi-purpose dry chemical type.

C. Fire Extinguisher Cabinet Assembly: Fire rating of cabinet to match fire rating of partition.

D. Box:

1. Mounting: Semi-recessed.
2. Material:
   a. Exterior exposed: 20 gage cold-rolled steel, with white epoxy finish.
   b. Interior or concealed: 20 gage cold-rolled steel, with white epoxy finish.

E. Doors and Trim: Material: 20 gage cold-rolled steel, with white epoxy finish.

1. Door Style: Bubble.
2. Bubble: Clear.
3. Lettering; Engraved letters.
   a. Style: Vertical, read from right edge.
   b. Color: Red.
   c. Handle: Manufacturers standard.

2.3 FIRE EXTINGUISHERS

A. Approved Manufacturers: Manufacturers and products as follows are acceptable. No substitutions.

1. Walter Kidde Company.
2. J. L. Industries, Inc.
3. Larsen's Manufacturing Company.
4. Potter-Roemer, Inc.

B. Provide extinguishers that do not contain ozone-depleting substances such as CFCs, HCFCs, or Halons.

C. Carbon Dioxide Type: FE-2.

1. Provide Class 10 B:C, UL listed and FMG Global approved carbon dioxide fire extinguishers.

2. Provide red enameled aluminum cylinder with pressure gauge, carrying handle, locking ring pin, squeeze-grip discharge lever, siphon tube, hose, discharge horn and mounting bracket.

3. Capacity shall be [15 pounds] {6.8 kg}.

D. Dry Chemical Multi-Purpose Type: FE-1.

1. Provide Class 4 A: 60 B:C, UL listed and FMG Global approved multi-purpose dry chemical stored pressure fire extinguishers.

2. Extinguishing agent shall be ammonium phosphate dry chemical.

3. Extinguishers shall be equipped with cylinder with pressure gauge, carrying handle, locking ring pin, squeeze-grip discharge lever, siphon tube, hose, discharge horn and mounting bracket. Finish shall be red enamel.

4. Capacity: [10 pounds] {4.5 kg}.

E. Provide manufacturer's standard wall brackets for wall mounted fire extinguishers, where cabinets are not indicated.

Part 3 EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for hose valves, hose racks, and cabinets to verify locations of piping connections before cabinet installation.

B. Examine walls and partitions for suitable framing depth and blocking where recessed and semi-recessed cabinets are to be installed.

C. Examine fire extinguishers for proper charging and tagging. Remove and replace damaged, defective, or undercharged units.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturer's written instructions for installing fire-protection specialties.

B. Install fire extinguishers and cabinets where indicated and in accordance with manufacturer's written instructions. Handle of extinguisher shall be a maximum of 54 inches above finished floor. Top of fire extinguisher to be at 42 inches

C. Install in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

1. Prepare recesses for cabinets as required by type and size of cabinet and trim style.

2. Fasten mounting brackets to structure and cabinets, square and plumb.

3. Fasten cabinets to structure, square and plumb.

D. Maintain extinguishers in fully charged condition and certify in writing they are fully charged and operational when Work is accepted.

3.3 INSTALLATION OF FIRE RATED EXTINGUISHER CABINETS

A. General: Install fire rated cabinets in accordance with manufacturer's written installation instructions.

B. Install fire rated cabinets with not more than 1/16 inch {1.5 mm} tolerance between pipe outside diameter and knockout outside diameter. Center pipe within knockout.

C. Seal through-penetrations with firestopping sealant specified in Firestopping: Division 7.

3.4 ADJUSTING AND CLEANING

A. Adjust cabinet doors that do not swing or operate freely.

B. Refinish or replace cabinets and doors damaged during installation.

C. Provide final protection and maintain conditions that ensure that cabinets and doors are without damage or deterioration at Date of Substantial Completion.

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END OF SECTION 104416

SECTION 105123 - PLASTIC-LAMINATE-CLAD LOCKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes plastic-laminate-clad wood lockers

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of locker.

B. Shop Drawings: For plastic-laminate-clad wood lockers.

1. Include plans, elevations, sections, and attachment details.
2. Show details full size.
3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
4. Show locations and sizes of cutouts and holes for items installed in lockers.
5. Show locker fillers, trim, base, sloping tops, and accessories.
6. Show locker identification system and numbering sequence.

C. Samples for Initial Selection: For each type of the following:

1. High-pressure decorative laminates.
2. Thermoset decorative overlay panels.

D. Samples for Verification: For the following products:

1. Plastic-laminate-clad panels, not less than 8 by 10 inches for each type, color, pattern, and surface finish.
2. Exposed cabinet hardware and accessories, one unit for each type and finish.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver lockers until painting and similar operations that could damage lockers have been completed in installation areas. If lockers must be stored in other-than-installation areas, store only in areas where environmental conditions are the same as those in final installation location, and comply with requirements specified in "Field Conditions" Article.

B. Deliver master and control keys to Owner.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install lockers until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.

B. Field Measurements: Where lockers are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings.

1. Locate concealed framing, blocking, and reinforcements that support lockers by field measurements before being enclosed, and indicate measurements on Shop Drawings.

C. Established Dimensions: Where lockers are indicated to fit to other construction, establish dimensions for areas where lockers are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

A. Coordinate sizes and locations of concealed wood support bases.

B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that lockers can be supported and installed as indicated.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of lockers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Structural failures.
   b. Faulty operation of locks or hardware.
   c. Deterioration of wood, finishes, and other materials beyond normal use.

2. Warranty Period: Threeyears from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: For lockers indicated to be accessible, comply with applicable provisions in ICC A117.1.

2.2 PLASTIC-LAMINATE-CLAD WOOD LOCKERS

A. Manufacturer: Basis of Design, Hollman Lockers. 800-433-3630

B. Construction Style: Flush overlay

C. Final Assembly: Manufacturer's standard factory assembly.

D. Locker Frame: Tops, sides and back shall be constructed of 5/8" high density thermo-fused melamine.
1. Expansion / contraction within +/- 1/16" per locker
2. Model as indicated on drawings.

E. Locker Doors: Laminate: 5/8 inch high-industrial grade particle board core with .030 inch vertical grade high pressure Class II-B fire retardant plastic laminate.
1. Matching laminate applied to interior and exterior door face as well as door edges.

F. End Panels: Match style, material, construction, and finish of plastic-laminate-clad wood doors.

G. Corners and Filler Panels: Match style, material, construction, and finish of plastic-laminate-clad wood doors.

H. Continuous Finish Base: Plastic-laminate-clad, 3/4-inch-thick panel that matches door faces; fabricated in lengths as long as practical to enclose base and base ends of lockers.

I. Plastic-Laminate Colors, Patterns, and Finishes:
1. Match Architect's samples.

2.3 MATERIALS

A. Composite Wood: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

1. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10.
2. Medium-Density Fiberboard: ANSI A208.2, Grade 130
3. Particleboard: ANSI A208.1, Grade M-2

B. High-Pressure Decorative Laminate: NEMA LD 3, grades as follows:

1. Horizontal Surfaces: Grade HGL.
2. Postformed Surfaces: Grade HGP.
3. Vertical Surfaces: Grade HGS

C. Wood Support Base: 2-by-6-inch, nominal-size lumber treated with manufacturer's standard preservative-treatment process.

2.4 HARDWARE

A. Keyless Lock: Keyless 360, model KEYLESS360-SN, finish Satin Nickel

B. Frameless Hinges (European Type): Fully concealed, nickel-plated steel, with not less than 125 degrees of opening.

1. Provide two hinges for doors 35 inches & under.
2. Provide three hinges for doors more than 35 inches and less than 59".

C. Accessible Handle: Metal, fixed, graspable lever handle and rose trim; surface mounted on accessible lockers only.

D. Shelf Rests: BHMA A156.9, B04013.

E. Hooks: Manufacturer's standard, ball-pointed aluminum or steel; chrome finished. Attach hooks with at least two fasteners.
1. Provide one double-prong wall hook for each compartment of interlocking lockers.

F. Coat Rods: 1-inch diameter steel; chrome finished.
1. Provide coat rod for each compartment of lockers.

G. Exposed Hardware Finish: Satin nickel unless otherwise indicated.

H. Exposed Hardware Finish: Unless otherwise indicated, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

2.5 ACCESSORIES

A. Number Identification Plates: 1-1/2-inch diameter, etched, embossed, or stamped, with black numbers and letters at least 1/2 inch high. Identify lockers in sequence indicated on Drawings. Plates to match keyless lock hardware.

2.6 FABRICATION

A. Fabricate each locker with shelves, an individual door and frame, an individual top, a bottom, and a back, and with common intermediate uprights separating compartments.

1. Fabricate lockers to dimensions, profiles, and details indicated.
2. Ease edges of corners of solid-wood members to 1/16-inch radius.

B. Fabricate lockers square, rigid, without warp, and with finished faces flat and free of dents, scratches, and chips. Accurately factory machine components for attachments. Make joints tight and true.

1. Fabricate lockers using manufacturer's standard construction, with joints made with dowels, dados, or rabbets. Dado side panels to receive shelving except where indicated to be adjustable.
2. Fabricate lockers with joints that are dadoed or rabbeted, glued full length, and stapled. Dado side panels to receive shelving except where indicated to be adjustable.

C. Accessible Lockers: Fabricate as follows:

1. Locate bottom shelf no lower than 15 inches above the floor.
2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches the floor.

D. Venting: Fabricate lockers with space between doors and locker assembly of not less than ½ inch.

E. Number Identification Plates: Inlay number plates flush in each locker door, near top, centered.

F. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that the parts fit as intended, and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.
2. Use only manufacturer's nuts, bolts, screws, and other devices for assembly.

G. Shop cut openings, to maximum extent possible, to receive hardware, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

H. Attach PVC edging to panels by thermally fusing edging to panels after panel fabrication.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and floors or support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify that furring is attached to concrete and masonry walls that are to receive lockers.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Condition lockers to average prevailing humidity conditions in installation areas before installation.

B. Before installing lockers, examine factory-fabricated work for completeness and complete work as required, including removal of packing.

3.3 INSTALLATION

A. Install wood support base with ½" plywood top.

B. Install lockers level, plumb, and true; use concealed shims.

C. Connect groups of lockers together with manufacturer's standard fasteners, through predrilled holes, with no exposed fasteners on face frames. Fit lockers accurately together to form flush, tight, hairline joints.

D. Install lockers without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings, providing unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Installation Tolerance: No more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line. Shim as required with concealed shims.

E. Locker Anchorage: Fasten lockers through wood locker base, at ends, and not more than 36 inches o.c. with screws sized for 1-inch penetration into wood base.

F. Locker Anchorage: Fasten lockers through back, near top and bottom, at ends and spaced not more than 16 inches o.c.

G. Scribe and cut corner and filler panels to fit adjoining work using fasteners concealed where practical. Repair damaged finish at cuts.

H. Attach sloping-top units to lockers, with end panels covering exposed ends.

I. Install number identification plates after lockers are in place.

1. Attach number identification plate on each locker door, near top, centered, with at least two screws with finish matching the plate.

3.4 ADJUSTING

A. Clean, lubricate, and adjust hardware. Adjust doors to operate easily without binding. Verify that integral locking devices operate properly.

3.5 PROTECTION

A. Protect lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.

B. Touch up marred finishes, or replace lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION 105123

SECTION 113013 APPLIANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Refrigeration appliances.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include installation details, material descriptions, dimensions of individual components, and finishes for each appliance.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Product Certificates: For each type of appliance.

C. Field quality-control reports.

D. Sample Warranties: For manufacturers' special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each residential appliance to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Maintains, within 25 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.

1.7 WARRANTY

A. Special Warranties: Manufacturer agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Appliances: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 ICEMAKERS

A. Icemaker: Model as indicated on drawings.

1. Front Panel: Stainless steel.

2. Appliance Color/Finish: Stainless Steel

2.3 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, power connections, and other conditions affecting installation and performance of residential appliances.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before appliance installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install appliances according to manufacturer's written instructions.

B. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.

C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

D. Range Anti-Tip Device: Install at each range according to manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Perform visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
2. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After installation, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.

B. An appliance will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain residential appliances.

END OF SECTION 113013

SECTION 122200 - CURTAINS AND DRAPES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Drapes.
2. Drapery tracks.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Drapery Tracks: Include maximum weights of drapes that can be supported.

2. Fabrics.
3. Textile treatments.

B. Shop Drawings:

1. Drapery Tracks: Show installation and anchorage details and locations of controls.

2. Drapes: Show sizes, locations, and details of installation.

C. Samples: As follows:

1. Drapery Tracks: 18 inches long, with carriers, controls, and accessories.
2. Drapery Fabrics: For each color and pattern indicated, full width by 36 inches long, from dye lot to be used for the Work and with specified textile treatments applied. Show complete pattern repeat if any. Mark top and face of fabric.
3. Textile Trims: For each color and pattern indicated, 18 inches long.
4. Drape Fabrication: For each heading, fabric, color, and pattern indicated, a complete full-size panel to verify details of fabrication and thread colors.

D. Product Schedule: For drapes and drapery tracks. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: For drapery track installation; reflected ceiling plans drawn to scale and coordinating track installation with openings and ceiling-mounted items, on which the following items are shown:

1. Suspended ceiling components.

B. Product Certificates: For each drapery fabric treated with flame retardant, signed by fabric supplier and indicating treatment durability and cleaning procedures required to maintain treatment effectiveness.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For products installed to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: For drapes and drapery tracks, fabricator of drapes.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build mockup for one length of final installation in Dance Studio 2.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify dimensions by field measurements before drape fabrication, and indicate measurements on Shop Drawings.

B. Scheduling: Do not deliver or install drapes until after other finish work, including painting, is complete and spaces are otherwise ready for occupancy.

PART 2 - **PRODUCTS**

2.1 DRAPERY TRACKS

A. Manually Operated Track for cord drawn installation:

1. Construction: Extruded aluminum, slotted for mounting at interval of not more than 24 inches o.c.

   a. Basis of Design: Kirch Architrac Series w/ concealed track and mounting. Lengths and Configurations: As indicated on Drawings.
   b. Support Capability: Weight of drape indicated mounted on track length indicated.
   c. Finish: To match architect's sample.

2. Mounting Brackets: Aluminum, of type suitable for fastening track to surface indicated and designed to support weight of track assembly and drape plus force applied to operate track.

   a. Mounting Surface: Wall assembly as indicated on drawings.
   b. Size: Adjustable

3. Installation Fasteners: Sized to support track assembly and drape, and fabricated from metal compatible with track, brackets, and supporting construction. Provide two fasteners to fasten each bracket to supporting construction.

4. Operation: Cord drawn complying with WCMA A 100.1.

   a. Pulley Mounting Location: Wall

b. Draw: Two way, center opening.
c. Operating Hardware Location: On stack side.

5. Carriers: Coordinate with drapery headings indicated.

a. Master Carriers: Butt

6. End Stops: Manufacturer's standard with track endcap.
7. Pulleys: Heavy duty.
8. Accessories: As required for complete installation with all fasteners and brackets concealed in finish construction.

2.2 DRAPES

A. Source Limitations: Obtain each color and pattern of drapery fabric and trim from one dye lot.

B. Fire-Test-Response Characteristics: For fabrics treated with fire retardants, provide products that pass NFPA 701 as determined by testing of fabrics that were treated using treatment-application method intended for use for this Project by a testing and inspecting agency acceptable to authorities having jurisdiction.

C. Drape: As indicated on finish schedule.

1. Heading:
   a. Roll Pleats (Ripplefold Header): 80 percent fullness.
   b. Heading Accessories:
      1) Woven snap tape, 7/8 inch wide, with nickel-plated snaps at 4 inches o.c. sewn at the top and bottom to a double turned 7/8 in top hem. The tape, with a shrinkgage of less than 3%, may be dry cleaned.

2. Drapery Fabric: As indicated on finish schedule.
3. Orientation: Run right (up the bolt).
4. Width: As indicated on drawings.
5. Textile Treatments: Stain repellent; and flame retardant, polymer type.

   a. Product: Selected by fabricator for use with drapery fabric indicated.
6. Hem Weights: 1-inch square lead weights

2.3 DRAPE FABRICATION

A. Fabricate drapes in heading styles and fullnesses indicated. Fabricate headings to stand erect. If less than a full width of fabric is required to produce panel of specified fullness, use equal widths of not less than one-half width of fabric located at ends of panel.

1. One-Way-Stacking Drapes: Add 5 inches to overall width for returns.
2. Center-Opening Drapes: Add 10 inches to overall width for overlap.

B. Seams: Sew vertical seams with twin-needle sewing machine with selvage trimmed and overlocked. Join widths so that patterns match and vertical seams lay flat and straight without puckering. Horizontal seams are unacceptable.

C. Side Hems: Double-turned, 1-1/2-inch wide hems consisting of three layers of fabric, and blindstitched so that stitches are invisible on face of drape.

D. Bottom Hems: Double-turned, 4-inch wide hems consisting of three layers of fabric, and weighted and blindstitched so that weights and stitches are invisible on face of drape.

1. Sew in square lead weights at each seam and at panel corners.

E. Interlinings: Extend from top of drape to within 1/2 inch of lining's bottom hem and to leading edge of side hems to produce full-shadowed appearance.

F. Linings: Equal to widths of drapery fabric and joined to drapery fabric at top by inside invisible seam, and hand stitched at side hems and shadowed with 1-1/2-inch return of face fabric.

1. Bottom Hem: Blind stitch to drapery fabric.

PART 3 - EXECUTION

3.1 DRAPERY TRACK INSTALLATION

A. Install track systems according to manufacturer's written instructions, level and plumb, and at height and location in relation to adjoining openings as indicated on Drawings.

B. Isolate metal parts of tracks and brackets from concrete, masonry, and mortar to prevent galvanic action. Use tape or another method recommended in writing by track manufacturer.

3.2 DRAPE INSTALLATION

A. Where drapes abut overhead construction, hang drapes so that clearance between headings and overhead construction is 1/4 inch.

B. Where drapes extend to floor, install so that bottom hems clear finished floor by not more than 1 inch and not less than 1/2 inch.

C. Where drapes extend to windowsill, install so that bottom hems hang above sill line and clear sill line by not more than 1/2 inch.

3.3 ADJUSTING

A. After hanging drapes, test and adjust each drapery track to produce unencumbered, smooth operation.

B. Steam and dress down drapes as required to produce crease- and wrinkle-free installation.

C. Remove and replace drapes that are stained or soiled.

END OF SECTION 122200

SECTION 122413 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Manually operated roller shades with single rollers.
2. Motor-operated roller shades with single rollers.

B. Related Requirements:

1. Section 061000 Rough Carpentry for wood blocking and grounds for mounting roller shades and accessories.
2. Section 079200 Joint Sealants for sealing the perimeters of installation accessories for light-blocking shades with a sealant.
3. Section 084413 Aluminum Curtainwall for attachment to curtainwall system.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

1. Motor-Operated Shades: Include details of installation and diagrams for power, signal, and control wiring.

C. Samples: For each exposed product and for each color and texture specified, 10 inches (250 mm) long.

D. Samples for Initial Selection: For each type and color of shadeband material.

1. Include Samples of accessories involving color selection.

E. Samples for Verification: For each type of roller shade.

1. Shadeband Material: Not less than [10 inches (250 mm)] square. Mark interior face of material if applicable.
2. Roller Shade: Full-size operating unit, not less than 16 inches (400 mm) wide by 36 inches (900 mm) long for each type of roller shade indicated.
3. Installation Accessories: Full-size unit, not less than 10 inches (250 mm) long.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of shadeband material.

C. Product Test Reports: For each type of shadeband material, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roller shades to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

A. Basis of Design: MechoShade

B. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.

1. Bead Chains: Stainless Steel

a. Loop Length: Full length of roller shade.
b. Limit Stops: Provide upper and lower ball stops.
c. Chain-Retainer Type: Clip, jamb mounted.

2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller shade weight and for lifting heavy roller shades.

a. Provide for shadebands that weigh more than 10 lbs or for shades as recommended by manufacturer, whichever criterion is more stringent.

C. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Roller Drive-End Location: To be coordinated with specific conditions so as to be accessible.
2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller
3. Shadeband-to-Roller Attachment: Manufacturer's standard method

D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

E. Shadebands:

1. Shadeband Material: Light Filtering
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

a. Type: Enclosed in sealed pocket of shadeband material

F. Installation Accessories:

1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners. Color of fascia to match Architect's sample.

a. Shape: L-shaped
b. Height: Manufacturer's standard height required to conceal roller and shadeband assembly when shade is fully open.

2. Endcap Covers: To cover exposed endcaps.
3. Recessed Shade Pocket: Rectangular, extruded-aluminum enclosure designed for recessed ceiling installation; with front, top, and back formed as one piece, end plates, and removable bottom closure panel.

a. Height: Manufacturer's standard height required to enclose roller and shadeband assembly when shade is fully open.
b. Provide pocket with lip at lower edge to support acoustical ceiling panel.

4. Closure Panel and Wall Clip: Removable aluminum panel designed for installation at bottom of site-constructed ceiling recess or pocket and for snap-in attachment to wall clip without fasteners.

a. Closure-Panel Width: 2 inches (51 mm)

2.3 MOTOR-OPERATED, SINGLE-ROLLER SHADES

A. Basis of Design: Mechoshade.

B. Motorized Operating System: Provide factory-assembled, shade-operator system of size and capacity and with features, characteristics, and accessories suitable for conditions indicated, complete with electric motor and factory-prewired motor controls, power disconnect switch, enclosures protecting controls and operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.

1. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Electric Motor: Design based on Mechoshade Whispershade IQ2 motor, enclosed in roller.

    a. Electrical Characteristics: 110-V ac
    b. Maximum Total Shade Width: As required to operate roller shades indicated.
    c. Maximum Shade Drop: As required to operate roller shades indicated
    d. Maximum Weight Capacity: As required to operate roller shades indicated

3. Remote Control: Electric controls with NEMA ICS 6, Type 1 enclosure for recessed or flush mounting. Provide the following for remote-control activation of shades:

    a. Group Control Station: Momentary-contact, three-position, rocker-style, wall-switch-operated control station with open, close, and center off functions for single-switch group control.
        1) Switch Positions: Five.
        2) Switch Style: Rocker.

    b. Color: White.
4. Limit Switches: Adjustable switches interlocked with motor controls and set to stop shades automatically at fully raised and fully lowered positions.
5. Operating Features:

    a. Group switching with integrated switch control; single faceplate for multiple switch cutouts.

C. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Roller Drive-End Location: To be coordinated with specific conditions so as to be accessible.
2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller
3. Shadeband-to-Roller Attachment: Manufacturer's standard method

D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
1. Mounting of shades in Dance Studios and Flex space shall be to curtainwall system.

E. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers that are operated by one roller drive-end assembly.

F. Shadebands:

1. Shadeband Material: Light-filtering fabric
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

    a. Type: Enclosed in sealed pocket of shadeband material

G. Installation Accessories:

1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.

   a. Shape: L-shaped
   b. Height: Manufacturer's standard height required to conceal roller and shadeband assembly when shade is fully open.

2. Endcap Covers: To cover exposed endcaps.

3. Closure Panel and Wall Clip: Removable aluminum panel designed for installation at bottom of site-constructed ceiling recess or pocket and for snap-in attachment to wall clip without fasteners.

   a. Closure-Panel Width: 2 inches.

2.4 SHADEBAND MATERIALS

A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701 Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.

1. Source: Roller shade manufacturer
2. Type: Thermoplastic olefin (TPO)
3. Weave: Basketweave
4. Roll Width: Min 8'-0"
5. Orientation on Shadeband: Up the bolt
6. Openness Factor: 1percent.
7. Color: Black / Brown

2.5 ROLLER SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):
   1. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible, except as follows:

1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4 provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.
2. Railroaded Materials: Railroad material where material roll width is less than the required width of shadeband and where indicated. Provide battens and seams as required by railroaded material to produce shadebands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shadeband.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, locations of connections to building electrical system, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

1. Opaque Shadebands: Located so shadeband is not closer than 2 inches (51 mm) to interior face of glass. Allow clearances for window operation hardware.

B. Electrical Connections: Connect motor-operated roller shades to building electrical system.

C. Roller Shade Locations: As indicated on Drawings

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

END OF SECTION 122413

SECTION 124813 **ENTRANCE MATS AND FRAMES**

Part 1 GENERAL

1.1 RELATED DOCUMENTS

A. Applicable Sections: Division 1.

B. Concrete Accessories: Division 3.

C. Cast-In-Place Concrete: Division 3.

D. Concrete Flatwork Finishing: Division 3, refer to for floor finish terminating edge to form floor depression.

E. Dimensional Stone: Division 4.

1.2 SUMMARY (NON-INCLUSIVE)

A. Section Includes: Nylon pile carpet mats and stainless-steel grids with frames.

1. Recess positioned.

B. Products Furnished but Not Installed Under This Section:

1. Cast-In-Place Concrete: Division 3, refer to for recess installation of mat frame in floor.

1.3 COORDINATION

A. Coordinate size and location of recesses in concrete to receive floor mats and frames.

1.4 SUBMITTALS

A. Submit per the requirements of Division 1.

B. Include construction details, material descriptions, dimensions of individual components and profiles joints if necessary, and finishes for floor mats and frames.

C. Samples: Full color range Samples for selection by Design Professional.

1) Floor Mat: Assembled sections of floor mat.

2) Tread Rail: Sample of each type and color.

3) Frame Members: Sample of each type and color.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: Include cleaning instructions and stain removal procedures.

B. Warranty: As indicated.

1.6 WARRANTY

A. Manufacturer's standard one (1) year Warranty from Date of Substantial Completion.

Part 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Products of Construction Specialties, Inc. are indicated to establish desired quality and performance of Work. Equivalent products of other manufacturers will be evaluated as substitutions in accordance with requirements of Division 1.

2.2 MATERIALS

A. Refer to Finish Legend for types and locations.

B. Carpet Mat (WOM-2): Basis of Design, DesignStep by Construction Specialties. Cut polypropylene pile permanently bonded to rubber backing, with face weight of 50 oz. per square yard, color as selected by Design Professional

1. Size as indicated.
2. Carpet installation: Direction of carpet texture shall be parallel to doors.

C. Entrance Mat (WOM-1): Basis of Design, PediTred G4 by Construction Specialties, 11/16" depth.

1. Recessed Frame: Aluminum alloy frame by Construction Specialties of depth matching mat, nominal thickness 1/8 inch with welded corners.
2. Tread Insert: MonoTuft HD Carpet Insert, Color to be selected by Architect from manufacturer's full line.
3. Underlayment Leveling Grout: As approved in writing by mat manufacturer.

2.3 ACCESSORIES

A. Anchors: As specified in Metal Fabrications: Division 5.

2.4 FABRICATION

A. Construct recessed mat frames square, with tight, rigid mitered corner joints. Coat surfaces with protective coating where in contact with cementitious materials.

B. Fabricate in shop to greatest extend possible. Provide single mat for each location. Where joints are necessary, align ends with doors or space symmetrically and away from normal traffic lanes. Verify sizes by field measurement before shop fabrication.

2.5 CONCRETE FILL AND GROUT MATERIALS

A. Provide concrete fill and grout equivalent in strength to cast-in-place concrete slabs for recessed mats and frames. Use aggregate no larger than one-third fill thickness.

2.6 FABRICATION: GENERAL

A. Floor Mats: Shop fabricate units to greatest extent possible in sizes indicated. Unless otherwise indicated, provide single unit for each mat installation; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints.

B. Recessed Frames: As indicated, for permanent recessed installation, complete with corner pins or reinforcement and anchorage devices.

1) Fabricate edge-frame members in single lengths or, where frame dimensions exceed maximum available lengths, provide minimum number of pieces possible, with hairline joints equally spaced and pieces spliced together by straight connecting pins.

Part 3 EXECUTION

3.1 EXAMINATION

A. Verify that floor openings are ready to receive Work.

B. Verify field measurements are as indicated on Drawings.

C. Beginning of installation means acceptance of existing conditions.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Furnish mat frames to concrete trades for installation. Include accessories and written installation instructions.

B. Furnish entrance grid frames to stone setting trades for installation. Include accessories and written installation instructions.

C. Install underlayment leveling grout as required to provide proper depth for mat installation.

D. Verify size of floor recess before cutting or fabricating mats and grids.

E. Vacuum clean floor recess.

F. Paint concrete surface underneath the grid frames dark grey (Sherwin-Williams: Caviar Sw6990)

3.3 INSTALLATION

A. Install recessed mat frames and mats to comply with manufacturer's written instructions so that tops of mats will be flush with adjoining finished flooring after final cleaning.

B. Set mats with tops at height recommended by manufacturer for most effective cleaning action; coordinate tops of mat surfaces with bottoms of doors that swing across mats to provide clearance between door and mat.

3.4 FIELD QUALITY CONTROL

A. Tolerances: Maximum Gap Allowed Between Recessed Frame and Mat: 1/8 inch at each side.

3.5 PROTECTION

A. After completing frame installation and concrete work, provide temporary filler of plywood or fiberboard in recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Substantial Completion

END OF SECTION 124813

SECTION 22 0517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe sleeves.

B. Manufactured sleeve-seal systems.

1.2 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 22 0553 - Identification for Plumbing Piping and Equipment: Piping identification.

C. Section 22 0719 - Plumbing Piping Insulation.

1.3 REFERENCE STANDARDS

A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a (Reapproved 2017).

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.

B. Provide temporary protective coating on cast iron and steel sleeves if shipped loose.

PART 2 PRODUCTS

2.1 MANUFACTURED SLEEVE-SEAL SYSTEMS

A. Manufacturers:
   1. 3M.
   2. Hilti.

B. Modular/Mechanical Seal:
   1. Synthetic rubber interlocking links continuously fill annular space between pipe and wall/casing opening.
   2. Provide watertight seal between pipe and wall/casing opening.
   3. Elastomer element size and material in accordance with manufacturer's recommendations.
   4. Glass reinforced plastic pressure end plates.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

3.2 INSTALLATION

A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

B. Install piping to conserve building space, to not interfere with use of space and other work.

C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

D. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.

E. Manufactured Sleeve-Seal Systems:
   1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
   2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
   3. Locate piping in center of sleeve or penetration.
   4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
   5. Tighten bolting for a water-tight seal.
   6. Install in accordance with manufacturer's recommendations.

F. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.3 CLEANING

A. Upon completion of work, clean all parts of the installation.

B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

END OF SECTION

SECTION 22 0519 - METERS AND GAUGES FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Thermometers and thermometer wells.

B. Static pressure gauges.

1.2 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2013.

B. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2014.

C. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers; 2014, with Editorial Revision (2017).

D. UL 393 - Indicating Pressure Gauges for Fire-Protection Service; Current Edition, Including All Revisions.

1.3 SUBMITTALS

A. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

PART 2 PRODUCTS

2.1 PRESSURE GAUGES

A. **Manufacturers:**
   1. **Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.**
   2. **Weksler Glass Thermometer Corp: www.wekslerglass.com/#sle.**
   3. **Omega Engineering, Inc: www.omega.com/#sle.**

B. Pressure Gauges: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.
   1. Case: Steel with brass bourdon tube.
   2. Size: 4-1/2 inch (115 mm) diameter.
   3. Mid-Scale Accuracy: One percent.
   4. Scale: Psi and kPa.

2.2 PRESSURE GAUGE TAPPINGS

A. Gauge Cock: Tee or lever handle, brass for maximum 150 psi (1034 kPa).

B. **Needle Valve: 1/4 inch (6 mm) NPT for minimum 150 psi (1034 kPa).**

2.3 STEM TYPE THERMOMETERS

A. **Manufacturers:**
   1. **Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.**
   2. **Omega Engineering, Inc: www.omega.com/#sle.**
   3. **Weksler Glass Thermometer Corp: www.wekslerglass.com/#sle.**

B. Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.
   1. Size: 9 inch (225 mm) scale.
   2. Window: Clear Lexan.
   3. Accuracy: 2 percent, per ASTM E77.
   4. Calibration: Degrees F.

2.4 STATIC PRESSURE GAUGES

A. Manufacturers:
   1. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
   2. Omega Engineering, Inc: www.omega.com/#sle.
   3. Weksler Glass Thermometer Corp: www.wekslerglass.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install pressure gauges with pulsation dampers. Provide gauge cock to isolate each gauge. Extend nipples and siphons to allow clearance from insulation.

C. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch (60 mm) for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

D. Provide instruments with scale ranges selected according to service with largest appropriate scale.

E. Install gauges and thermometers at water heaters in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

F. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

END OF SECTION

SECTION 22 0523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Applications.

B. General requirements.

C. Ball valves.

1.2 RELATED REQUIREMENTS

A. Section 08 3100 - Access Doors and Panels.

B. Section 22 0553 - Identification for Plumbing Piping and Equipment.

C. Section 22 0719 - Plumbing Piping Insulation.

D. Section 22 1005 - Plumbing Piping.

1.3 REFERENCE STANDARDS

A. ASME B1.20.1 - Pipe Threads, General Purpose (Inch); 2013 (Reaffirmed 2018).

B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2018.

C. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings; 2017.

D. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves; 2013.

E. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010.

F. NSF 61 - Drinking Water System Components - Health Effects; 2019.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

1.5 QUALITY ASSURANCE

A. Manufacturer:
   1. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.

PART 2 PRODUCTS

2.1 APPLICATIONS

A. Provide the following valves for the applications if not indicated on drawings:
   1. Shutoff: Ball, butterfly, gate, plug, or _____.
   2. Swing Check (Pump Outlet):
      a. 2 NPS (50 DN) and Smaller: Bronze swing check valves with bronze, nonmetallic, or _____ disc.

B. Substitutions of valves with higher CWP classes or SWP ratings for same valve types are permitted when specified CWP ratings or SWP classes are not available.

C. Required Valve End Connections for Non-Wafer Types:
   1. Copper Tube:
      a. 2 NPS (50 DN) and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.

D. Domestic, Hot and Cold Water Valves:
   1. 2 NPS (50 DN) and Smaller:
      a. Bronze and Brass: Provide with solder-joint or _____ ends.
      b. Ball: One piece, full port, brass or _____ with brass trim.
      c. Bronze Swing Check: Class 125, bronze disc.

2.2 GENERAL REQUIREMENTS

A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.

B. Valve Sizes: Match upstream piping unless otherwise indicated.

C. Valve Actuator Types:

D. Valve-End Connections:

E. General ASME Compliance:

2.3 BRASS BALL VALVES

A. One-Piece, Reduced-Port with Brass Trim:
   1. Comply with MSS SP-110.
   2. Body: Forged brass.
   3. Ends: Threaded.
   4. Seats: PTFE or ____.
   5. Stem: Brass.
   6. Ball: Chrome-plated brass.

2.4 BRONZE BALL VALVES

A. One Piece, Reduced Port with Bronze Trim:
   1. Comply with MSS SP-110.
   2. SWP Rating: 400 psig (2760 kPa).
   3. CWP Rating: 600 psig (4140 kPa).
   4. Body: Bronze.
   5. Ends: Threaded.
   6. Seats: PTFE or ____.

2.5 BRONZE SWING CHECK VALVES

A. Class 125: CWP Rating: 200 psig (1380 kPa) and _____.
   1. Comply with MSS SP-80, Type 3.
   2. Design: Horizontal flow.
   3. Body: Bronze, ASTM B62.
   4. Ends: Threaded as indicated.
   5. Disc: Bronze.

END OF SECTION

SECTION 22 0529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Support and attachment components for equipment, piping, and other plumbing work.

1.2 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General - Purpose Piping; 2014.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2018).

F. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2015.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.

H. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

I. MFMA-4 - Metal Framing Standards Publication; 2004.

J. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018.

K. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.3 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, nonpenetrating rooftop supports, post-installed concrete and masonry anchors, and thermal insulated pipe supports.
   1. Fiberglass Channel (Strut) Framing Systems: Include requirements for strength derating according to ambient temperature.

1.4 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
   2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
   3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
   4. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
      a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
      b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Metal Channel (Strut) Framing Systems:
   1. Manufacturers:
      a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com/#sle.
      b. Thomas & Betts Corporation: www.tnb.com/#sle.

c. Unistrut, a brand of Atkore International Inc: www.unistrut.com/#sle.
2. Comply with MFMA-4.

C. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
1. Minimum Size, Unless Otherwise Indicated or Required:
a. Equipment Supports: 1/2 inch (13 mm) diameter.
b. Piping up to 1 inch (27 mm) nominal: 1/4 inch (6 mm) diameter.
c. Piping larger than 1 inch (27 mm) nominal: 3/8 inch (10 mm) diameter.

D. Thermal Insulated Pipe Supports:
1. Manufacturers:
a. Buckaroos, Inc: www.buckaroos.com/#sle.
b. KB Enterprises: www.snappitz.com/#sle.
2. General Construction and Requirements:
a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
b. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
c. Pipe supports to be provided for nominally sized, 1/2 inch to 30 inch (12.7 mm to 762 mm) iron pipes.
d. Insulation inserts to consist of rigid phenolic foam insulation surrounded by a 360 degree, PVC jacketing.
3. PVC Jacket:
a. Pipe insulation protection shields to be provided with a ball bearing hinge and locking seam.
b. Moisture Vapor Transmission: 0.0071 perm inch (0.0092 ng/Pa s m), when tested in accordance with ASTM E96/E96M.
c. Thickness: 60 mil (1.524 mm).

E. Pipe Supports:
1. Liquid Temperatures Up To 122 degrees F (50 degrees C):
a. Overhead Support: MSS SP-58 Types 1, 3 through 12.
b. Support From Below: MSS SP-58 Types 35 through 38.

F. Beam Clamps: MSS SP-58 Types 19 through 23, 25 or 27 through 30 based on required load.
1. Material: ASTM A36/A36M carbon steel or ASTM A181/A181M forged steel.
2. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.

G. Riser Clamps:
1. Provide copper plated clamps for copper tubing support.
2. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.

H. Offset Pipe Clamps: Double-leg design two-piece pipe clamp.

I. Pipe Hangers: For a given pipe run, use hangers of the same type and material.
1. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
2. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.

J. Intermediate Pipe Guides: Use pipe clamps with oversize pipe sleeve that provides clearance around pipe.
1. Pipe Diameter 6 inches (150 mm) and Smaller: Provide minimum clearance of 0.16 inch (4 mm).
2. Pipe Diameter 8 inches (200 mm): Provide U-bolts with double nuts providing minimum clearance of 0.28 inch (7 mm).
3. Pipe Diameter 8 inches (200 mm): 0.625 inch (16 mm) U-bolt.
4. Pipe Diameter 10 inches (250 mm): 0.75 inch (19 mm) U-bolt.
5. Pipe Diameter 12 to 16 inches (300 to 400 mm): 0.875 inch (24 mm) U-bolt.
6. Pipe Diameter 18 to 30 inches (450 to 750 mm): 1 inch (25 mm) U-bolt.

K. Pipe Alignment Guides: Galvanized steel.
1. Pipe Diameter 8 inches (200 mm) and Smaller: Spider or sleeve type.
2. Pipe Diameter 10 inches (250 mm) and Larger: Roller type.

L. Dielectric Barriers: Provide between metallic supports and metallic piping and associated items of dissimilar type; acceptable dielectric barriers include rubber or plastic sheets or coatings attached securely to pipe or item.

M. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.

4. Hollow Masonry: Use toggle bolts.
5. Hollow Stud Walls: Use toggle bolts.
6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
7. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
    a. Comply with MFMA-4.
    b. Channel Material: Use galvanized steel.
    c. Manufacturer: Same as manufacturer of metal channel (strut) framing system.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.

C. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

D. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

E. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

F. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.

G. Equipment Support and Attachment:
    1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
    2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
    3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
    4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.

I. Secure fasteners according to manufacturer's recommended torque settings.

J. Remove temporary supports.

3.3 FIELD QUALITY CONTROL

A. Inspect support and attachment components for damage and defects.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 22 0533 - HEAT TRACING FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Self-regulating parallel resistance electric heating cable.

B. Cable outer jacket markings.

C. Connection kits.

D. Accessories.

E. Controls.

1.2 REFERENCE STANDARDS

A. IEEE 515.1 - IEEE Standard for the Testing, Design, Installation, and Maintenance of Electrical Resistance Trace Heating for Commercial Applications; 2012.

B. ITS (DIR) - Directory of Listed Products; current edition.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL (DIR) - Online Certifications Directory; Current Edition.

1.3 SUBMITTALS

A. Product Data: Provide data for electric heat tracing.

B. Shop Drawings: Indicate electric heat tracing layout, electrical terminations, thermostats, controls, and branch circuit connections.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

PART 2 PRODUCTS

2.1 SELF-REGULATING PARALLEL RESISTANCE ELECTRIC HEATING CABLE

A. Manufacturers:
   1. Chromalox, Inc: www.chromalox.com/#sle.
   2. Pentair: www.pentairthermal.com/#sle.
   3. Thermon Manufacturing Company: www.thermon.com/#sle.

B. Provide products listed, classified, and labeled by UL (DIR), ITS (DIR), or testing firm acceptable to authorities having jurisdiction (AHJ).

C. Factory Rating and Testing: Comply with IEEE 515.1.

D. Heating Element:
   1. Provide pair of parallel No.16 tinned or nickel coated stranded copper bus wires embedded in cross linked conductive polymer core with varying heat output in response to temperature along its length.
   2. Terminations: Waterproof, factory assembled, non-heating leads with connector at one end and water-tight seal at opposite end.
   3. Capable of crossing over itself without overheating.

E. Insulated Jacket: Flame retardant polyolefin.

F. Cable Cover: Provide tinned copper and polyolefin outer jacket.

G. Maximum Power-On Operating Temperature: 150 degrees F (65 degrees C).

H. Maximum Power-Off Exposure Temperature: 185 degrees F (85 degrees C).

I. Electrical Characteristics:

2.2 CABLE OUTER JACKET MARKINGS

A. Name of manufacturer, trademark, or other recognized symbol of identification.

B. Catalog number, reference number, or model.

C. Month and year of manufacture, date coding, applicable serial number, or equivalent.

D. Agency listing or approval.

2.3 CONNECTION KITS

A. Provide power connection, splice/tee, and end seal kits compatible with the heating cable and without requiring cutting of the cable core to expose bus wires.

B. Provide with NEMA 4X rating for prevention of corrosion and water ingress.

2.4 ACCESSORIES

A. Provide Accessories As Indicated or As Required for Complete Installation, Including but Not Limited To:
   1. High temperature, glass filament tape for attachment of heating cable to metal piping.
   2. Heat-conductive putty.
   3. Cable ties.
   4. Silicone end seals and splice kits.
   5. Installation clips.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that piping and equipment are ready to receive work.

B. Verify field measurements are as indicated on shop drawings.

C. Verify required power is available, in proper location, and ready for use.

3.2 PREPARATION

A. Clean exposed surfaces prior to installation.

B. Prepare surfaces using approved methods as recommended by manufacturer.

3.3 INSTALLATION

A. Install in accordance with manufacturer's written installation instructions.

B. Comply with installation requirements of IEEE 515.1 and NFPA 70, Article 427.

C. Apply heating cable linearly on pipe with fiberglass tape only after piping has successfully completed any required pressure testing.

D. Comply with applicable local building codes and requirements of authorities having jurisdiction.

E. Identification:
   1. After thermal insulation installation, apply external pipeline decals to indicate presence of the thermal insulation cladding at intervals not to exceed 20 ft (6 m) including cladding over each valve or other equipment that may require maintenance.

3.4 FIELD QUALITY CONTROL

A. Perform start-up by factory technician or factory representative as per Owner's requirements.

B. Field Testing and Inspections:
   1. Commission system in accordance with installation and operation manual.
   2. Inspect for sources of water entry and proper sealing.
   3. Inspect weather barrier to confirm that no sharp edges are contacting the trace heating.
   4. Insulation Resistance: Greater than 20 megohms at a test voltage of 2500 VDC for polymer insulated trace heaters.
   5. Test heating cable integrity with megohmmeter at the following intervals:
   6. Measure voltage and current at each unit.
   7. Controls:

3.5 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

SECTION 22 0548 - VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Vibration isolation requirements.

B. Vibration-isolated equipment support bases.

C. Vibration isolators.

1.2 DEFINITIONS

A. Plumbing Component: Where referenced in this section in regards to seismic controls, applies to any portion of the plumbing system subject to seismic evaluation in accordance with applicable codes, including distributed systems (e.g., piping).

1.3 REFERENCE STANDARDS

A. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; Most Recent Edition Cited by Referring Code or Reference Standard.

B. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.
   1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification methods for spring element load capacities.

B. **Shop Drawings - Vibration Isolation Systems:**
   1. **Include dimensioned plan views and sections indicating proposed arrangement of vibration isolators; indicate equipment weights and static deflections.**
   2. **Vibration-Isolated Equipment Support Bases: Include base weights, including concrete fill where applicable; indicate equipment mounting provisions.**

1.5 QUALITY ASSURANCE

A. Comply with applicable building code.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 VIBRATION ISOLATION REQUIREMENTS

A. Provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing plumbing equipment and/or plumbing connections to vibration-isolated equipment.

B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:

C. General Requirements:
   1. Select vibration isolators to provide required static deflection.
   2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.

D. Piping Isolation:
   1. Provide vibration isolators for piping supports:
      a. Located in equipment rooms.
      b. Located within 15 feet (_____ m) of connected vibration-isolated equipment and pressure-regulating valve (PRV) stations.
   2. Minimum Static Deflection:
      a. First Three Supports Closest to Isolated Equipment: Same as static deflection of equipment; maximum of 2 inch (50 mm) deflection required.
      b. Remainder of Supports: 0.75 inch (19 mm) deflection unless otherwise indicated.
   3. Suspended Piping, Nonseismic Applications: Use resilient material isolator hangers, spring isolator hangers, or combination resilient material/spring isolator hangers.
   4. Floor-Mounted Piping, Nonseismic Applications: Use open (unhoused) spring isolators.

2.2 VIBRATION-ISOLATED EQUIPMENT SUPPORT BASES

A. Manufacturers:
   1. Vibration-Isolated Equipment Support Bases:
      a. Kinetics Noise Control, Inc: www.kineticsnoise.com/#sle.
      b. Mason Industries: www.mason-ind.com/#sle.
      c. Vibration Eliminator Company, Inc: www.veco-nyc.com/#sle.
   2. Source Limitations: Furnish vibration-isolated equipment support bases and associated components and accessories produced by the same manufacturer as the vibration isolators and obtained from a single supplier.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C. Secure fasteners according to manufacturer's recommended torque settings.

D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

E. Vibration Isolation Systems:
   1. Vibration-Isolated Equipment Support Bases:
      a. Provide specified minimum clearance beneath base.
   2. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.
   3. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.
   4. Adjust isolators to be free of isolation short circuits during normal operation.
   5. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.

3.3 FIELD QUALITY CONTROL

A. Inspect vibration isolation and/or seismic control components for damage and defects.

B. Vibration Isolation Systems:
   1. Verify isolator static deflections.
   2. Verify vibration isolation performance during normal operation; investigate sources of isolation short circuits.

C. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.

END OF SECTION

SECTION 22 0553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe markers.

1.2 SUBMITTALS

A. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

C. Product Data: Provide manufacturers catalog literature for each product required.

PART 2 PRODUCTS

2.1 IDENTIFICATION APPLICATIONS

A. Piping: Pipe markers. Pipe markings shall be per Rowan University's Color Code Standard.

B. Small-sized Equipment: Tags.

C. Tanks: Nameplates.

D. Valves: Tags.

2.2 NAMEPLATES

A. Manufacturers:
   1. Brady Corporation: www.bradycorp.com/#sle
   2. Brimar Industries, Inc: www.pipemarker.com/#sle.
   3. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
   4. Seton Identification Products: www.seton.com/#sle.

B. Description: Laminated three-layer plastic with engraved letters.

2.3 TAGS

A. Manufacturers:
   1. Brady Corporation: www.bradycorp.com/#sle.
   2. Brimar Industries, Inc: www.pipemarker.com/#sle.
   3. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
   4. Seton Identification Products: www.seton.com/#sle.

B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch (40 mm) diameter with smooth edges.

2.4 PIPE MARKERS

A. Manufacturers:
   1. Brady Corporation: www.bradycorp.com/#sle.
   2. Brimar Industries, Inc: www.pipemarker.com/#sle.
   3. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
   4. Seton Identification Products: www.seton.com/#sle.

B. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

END OF SECTION

SECTION 22 0719 - PLUMBING PIPING INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.2 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 22 1005 - Plumbing Piping: Placement of hangers and hanger inserts.

1.3 REFERENCE STANDARDS

A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019.

B. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2017.

C. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2018).

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.

E. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

F. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.6 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.2 GLASS FIBER

A. Manufacturers:
   1. CertainTeed Corporation: www.certainteed.com/#sle.
   2. Johns Manville Corporation: www.jm.com/#sle.
   3. Knauf Insulation; Earthwool 1000 Degree Pipe Insulation: www.knaufinsulation.com/#sle.
   4. Owens Corning Corporation; Fiberglas Pipe Insulation ASJ: www.ocbuildingspec.com/#sle.

B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
   1. K (Ksi) Value: ASTM C177, 0.24 at 75 degrees F (0.035 at 24 degrees C).
   2. Maximum Service Temperature: 850 degrees F (454 degrees C).
   3. Maximum Moisture Absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches (0.029 ng/Pa s m).

2.3 JACKETS

A. PVC Plastic.
   1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
      a. Minimum Service Temperature: 0 degrees F (Minus 18 degrees C).
      b. Maximum Service Temperature: 150 degrees F (66 degrees C).

c. Moisture Vapor Permeability: 0.002 perm inch (0.0029 ng/Pa s m), maximum, when tested in accordance with ASTM E96/E96M.
d. Thickness: 10 mil (0.25 mm).
e. Connections: Brush on welding adhesive.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Insulation thickness shall meet the requirements of the New Jersey Energy Standard which is ASHRAE 90.1 - 2016.

B. Install in accordance with manufacturer's instructions.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.

E. Glass fiber insulated pipes conveying fluids below ambient temperature:
1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. For hot piping conveying fluids over 140 degrees F (60 degrees C), insulate flanges and unions at equipment.

G. Glass fiber insulated pipes conveying fluids above ambient temperature:
1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

H. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 8400.

I. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer.

END OF SECTION

SECTION 22 1005 - PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe, pipe fittings, specialties, and connections for piping systems.
   1. Sanitary sewer.
   2. Domestic water.
   3. Storm water.
   4. Flanges, unions, and couplings.
   5. Pipe hangers and supports.
   6. Valves.

1.2 RELATED REQUIREMENTS

A. Section 08 3100 - Access Doors and Panels.

B. Section 22 0516 - Expansion Fittings and Loops for Plumbing Piping.

C. Section 22 0553 - Identification for Plumbing Piping and Equipment.

D. Section 22 0719 - Plumbing Piping Insulation.

1.3 REFERENCE STANDARDS

A. ANSI Z21.22 - American National Standard for Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems; 2015.

B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2018.

C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2018.

D. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV; 2017.

E. ASME B31.9 - Building Services Piping; 2017.

F. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers; 2019.

G. ASSE 1003 - Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems; 2009.

H. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2017.

I. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).

J. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2015a.

K. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2016.

L. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2016.

M. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2016.

N. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2014.

O. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings; 2012.

P. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2017.

Q. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2017, with Errata (2018).

R. AWWA C550 - Protective Interior Coatings for Valves and Hydrants; 2017.

S. AWWA C651 - Disinfecting Water Mains; 2014.

T. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications; 2017 (Revised 2018).

U. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2012 (Revised 2018).

V. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018.

W. NSF 61 - Drinking Water System Components - Health Effects; 2019.

X. NSF 372 - Drinking Water System Components - Lead Content; 2016.

1.4 SUBMITTALS

A. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.2 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING

A. Cast Iron Pipe: ASTM A74 service weight.
   1. Fittings: Cast iron.
   2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.

2.3 SANITARY SEWER PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hubless, service weight.
   1. Fittings: Cast iron.
   2. Joints: CISPI 310, neoprene gaskets and stainless steel Heavy Duty clamp-and-shield assemblies.

B. Copper Tube: ASTM B88 (ASTM B88M), Type K (A).
   1. Fittings: ASME B16.29, wrought copper.
   2. Joints: ASTM B32, alloy Sn50 solder.

2.4 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING

A. Ductile Iron Pipe: AWWA C151/A21.51.
   1. Fittings: Ductile or gray iron, standard thickness.
   2. Joints: AWWA C111/A21.11, styrene butadiene rubber (SBR) or vulcanized SBR gasket with 3/4 inch (19 mm) diameter rods.

2.5 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), Drawn (H).
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
   2. Joints: ASTM B32, alloy Sn95 solder.
   3. Mechanical Press Sealed Fittings: Double-pressed type, NSF 61 and NSF 372 approved or certified, utilizing EPDM, nontoxic, synthetic rubber sealing elements.
      a. Manufacturers:
         1 Apollo Valves: www.apollovalves.com/#sle.
         2 Grinnell Products: www.grinnell.com/#sle.
         3 Viega LLC: www.viega.us/#sle.

B. Ductile Iron Pipe: AWWA C151/A21.51.
   1. Fittings: Ductile or gray iron, standard thickness.
   2. Joints: AWWA C111/A21.11, styrene butadiene rubber (SBR) or vulcanized SBR gasket with 3/4 inch (19 mm) diameter rods.

2.6 STORM WATER PIPING, BURIED BEYOND 5 FEET (1500 MM) OF BUILDING

2.7 STORM WATER PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING

A. Cast Iron Pipe: ASTM A74 service weight.
   1. Fittings: Cast iron.

2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.

2.8 STORM WATER PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hubless, service weight.
   1. Fittings: Cast iron.
   2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.9 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches (80 mm) and Under:
   1. Ferrous pipe: Class 300 malleable iron threaded unions.
   2. Copper tube and pipe: Class 300 bronze unions with soldered joints.

B. Flanges for Pipe Size Over 1 Inch (25 mm):
   1. Ferrous Pipe: Class 300 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
   2. Copper Tube and Pipe: Class 300 slip-on bronze flanges; preformed neoprene gaskets.

2.10 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
   1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
   2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
      a. Cold and Hot Pipe Sizes 6 Inches (150 mm) and Over: Double hangers.
   3. Trapeze Hangers: Welded steel channel frames attached to structure.
   4. Vertical Pipe Support: Steel riser clamp.

B. Plumbing Piping - Drain, Waste, and Vent:
   1. Hangers for Pipe Sizes 1/2 Inch (15 mm) to 1-1/2 Inches (40 mm): Malleable iron, adjustable swivel, split ring.
   2. Hangers for Pipe Sizes 2 Inches (50 mm) and Over: Carbon steel, adjustable, clevis.
   3. Wall Support for Pipe Sizes to 3 Inches (80 mm): Cast iron hook.
   4. Wall Support for Pipe Sizes 4 Inches (100 mm) and Over: Welded steel bracket and wrought steel clamp.
   5. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   6. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

C. Plumbing Piping - Water:
   1. Hangers for Pipe Sizes 1/2 Inch (15 mm) to 1-1/2 Inches (40 mm): Malleable iron, adjustable swivel, split ring.
   2. Hangers for Cold Pipe Sizes 2 Inches (50 mm) and Over: Carbon steel, adjustable, clevis.
   3. Hangers for Hot Pipe Sizes 2 Inches (50 mm) to 4 Inches (100 mm): Carbon steel, adjustable, clevis.
   4. Hangers for Hot Pipe Sizes 6 Inches (150 mm) and Over: Adjustable steel yoke, cast iron pipe roll, double hanger.
   5. Wall Support for Pipe Sizes to 3 Inches (80 mm): Cast iron hook.
   6. Wall Support for Pipe Sizes 4 Inches (100 mm) and Over: Welded steel bracket and wrought steel clamp.
   7. Wall Support for Hot Pipe Sizes 6 Inches (150 mm) and Over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron pipe roll.
   8. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   9. Floor Support for Hot Pipe Sizes to 4 Inches (100 mm): Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and concrete pier or steel support.
   10. Floor Support for Hot Pipe Sizes 6 Inches (150 mm) and Over: Adjustable cast iron pipe roll and stand, steel screws, and concrete pier or steel support.
   11. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.11 BALL VALVES

A. Manufacturers:
   1. Anvil International: www.anvilintl.com/#sle.
   2. Apollo Valves: www.apollovalves.com/#sle.
   3. Grinnell Products: www.grinnell.com/#sle.
   4. Nibco, Inc: www.nibco.com/#sle.

2.12 WATER PRESSURE REDUCING VALVES

A. Manufacturers:
   1. Amtrol Inc: www.amtrol.com/#sle.
   2. Apollo Valves: www.apollovalves.com/#sle.
   3. Watts Regulator Company: www.wattsregulator.com/#sle.

B. Up to 2 Inches (50 mm):
   1. ASSE 1003, bronze body, stainless steel, and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded single union ends.

C. Over 2 Inches (50 mm):
   1. ASSE 1003, cast iron body with interior lining complying with AWWA C550, bronze fitted, elastomeric diaphragm and seat disc, flanged.

2.13 RELIEF VALVES

A. Temperature and Pressure:
   1. ANSI Z21.22, AGA certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F (98.9 degrees C), capacity ASME BPVC-IV certified and labelled.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

G. Provide access where valves and fittings are not exposed.

H. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welding.

I. Provide support for utility meters in accordance with requirements of utility companies.

J. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.

K. Sleeve pipes passing through partitions, walls, and floors.

L. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9.
   2. Support horizontal piping as indicated.
   3. Install hangers to provide minimum 1/2 inch (15 mm) space between finished covering and adjacent work.
   4. Place hangers within 12 inches (300 mm) of each horizontal elbow.
   5. Use hangers with 1-1/2 inch (40 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
   7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
   8. Provide copper plated hangers and supports for copper piping.
   9. Support cast iron drainage piping at every joint.

3.4 APPLICATION

A. Use grooved mechanical couplings and fasteners only in accessible locations.

B. Install unions downstream of valves and at equipment or apparatus connections.

C. Install gate or ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

D. Install globe valves for throttling, bypass, or manual flow control services.

E. Provide lug end butterfly valves adjacent to equipment when provided to isolate equipment.

3.5 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, verify system is complete, flushed, and clean.

B. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

C. Inject disinfectant, free chlorine in liquid, powder, tablet, or gas form throughout system to obtain 50 to 80 mg/L residual.

D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

E. Maintain disinfectant in system for 24 hours.

F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.6 SERVICE CONNECTIONS

A. Provide new sanitary and storm sewer services. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

B. Provide new water service complete with approved reduced pressure backflow preventer and water meter with by-pass valves, pressure reducing valve, and sand strainer.

3.7 SCHEDULES

A. Pipe Hanger Spacing:
   1. Metal Piping:
      a. Pipe Size: 1/2 inches (15 mm) to 1-1/4 inches (32 mm):
         1 Maximum Hanger Spacing: 6.5 ft (2 m).
         2 Hanger Rod Diameter: 3/8 inches (9 mm).
      b. Pipe Size: 1-1/2 inches (40 mm) to 2 inches (50 mm):
         1 Maximum Hanger Spacing: 10 ft (3 m).
         2 Hanger Rod Diameter: 3/8 inch (9 mm).
      c. Pipe Size: 2-1/2 inches (65 mm) to 3 inches (75 mm):
         1 Maximum Hanger Spacing: 10 ft (3 m).
         2 Hanger Rod Diameter: 1/2 inch (13 mm).

END OF SECTION

SECTION 22 1006 - PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Drains.
B. Cleanouts.
C. Hydrants.
D. Refrigerator valve and recessed box.
E. Water hammer arrestors.
F. Mixing valves.

1.2 RELATED REQUIREMENTS

A. Section 22 1005 - Plumbing Piping.
B. Section 22 3000 - Plumbing Equipment.
C. Section 22 4000 - Plumbing Fixtures.

1.3 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
B. ASME A112.6.3 - Floor and Trench Drains; 2019.
C. ASME A112.6.4 - Roof, Deck, and Balcony Drains; 2008 (Reaffirmed 2012).
D. ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers; 2017.
E. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers; 2011.
F. ASSE 1019 - Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance; 2011 (Reaffirmed 2016).
G. NSF 61 - Drinking Water System Components - Health Effects; 2019.
H. NSF 372 - Drinking Water System Components - Lead Content; 2016.
I. PDI-WH 201 - Water Hammer Arresters; 2017.

1.4 SUBMITTALS

A. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.2 DRAINS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company: www.jayrsmith.com/#sle.
   2. Josam Company: www.josam.com/#sle.
   3. Zurn Industries, LLC: www.zurn.com/#sle.

B. Roof Drains:
   1. Assembly: ASME A112.6.4.
   2. Body: Lacquered cast iron with sump.
   3. Strainer: Removable cast iron dome with vandal proof screws.
   4. Accessories: Coordinate with roofing type, :
      a. Membrane flange and membrane clamp with integral gravel stop.
      b. Adjustable under deck clamp.
      c. Roof sump receiver.
      d. Waterproofing flange.
      e. Controlled flow weir.

f. Leveling frame.
g. Adjustable extension sleeve for roof insulation.

5. Manufacturers:
   a. Jay R. Smith Manufacturing Company; _____: www.jrsmith.com/#sle.
   b. Josam Company: www.josam.com/#sle.
   c. Zurn Industries, LLC: www.zurn.com/#sle.

C. Floor Drain (FD-1):
1. ASME A112.6.3; lacquered cast iron or stainless steel, two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer.

2.3 CLEANOUTS

A. Manufacturers:
1. Jay R. Smith Manufacturing Company: www.jayrsmith.com/#sle.
2. Josam Company: www.josam.com/#sle.
3. Zurn Industries, LLC: www.zurn.com/#sle.

B. Cleanouts at Exterior Surfaced Areas :
1. Round cast nickel bronze access frame and non-skid cover.

C. Cleanouts at Interior Finished Floor Areas:
1. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round gasketed scored cover in service areas and round gasketed depressed cover to accept floor finish in finished floor areas.

D. Cleanouts at Interior Finished Wall Areas :
1. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.

2.4 HYDRANTS

A. Manufacturers:
1. Jay R. Smith Manufacturing Company: www.jayrsmith.com/#sle.
2. Zurn Industries, LLC: www.zurn.com/#sle.
3. Josam Company: www.josam.com/#sle.

B. Wall Hydrants:
1. ASSE 1019; freeze resistant, self-draining type with wall plate hose thread spout, lockshield and removable key, and integral vacuum breaker.

2.5 WATER HAMMER ARRESTORS

A. Manufacturers:
1. Jay R. Smith Manufacturing Company: www.jayrsmith.com/#sle.
2. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com/#sle.
3. Zurn Industries, LLC: www.zurn.com/#sle.

B. Water Hammer Arrestors:
1. Stainless steel construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range minus 100 to 300 degrees F (minus 73 to 149 degrees C) and maximum 250 psi (1700 kPa) working pressure.

2.6 MIXING VALVES

A. Thermostatic Mixing Valves:
1. Manufacturers:
   a. Leonard Valve Company: www.leonardvalve.com/#sle.
   b. Watts
2. Valve: Chrome plated cast brass body, stainless steel or copper alloy bellows, integral temperature adjustment.

2.7 FLOOR DRAIN TRAP SEALS

A. Manufacturers:
1. MIFAB, Inc: www.mifab.com/#sle.

B. Description: Push-fit EPDM or silicone fitting with a one-way membrane.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

C. Encase exterior cleanouts in concrete flush with grade.

D. Install floor cleanouts at elevation to accommodate finished floor.

E. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibbs.

F. Pipe relief from backflow preventer to nearest drain.

G. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to all sensor operated valves and fast closeing solinoid valves.

END OF SECTION

SECTION 22 3000 - PLUMBING EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Water Heaters:
   1. Commercial electric.

B. Domestic hot water storage tanks.

C. Diaphragm-type compression tanks.

1.2 RELATED REQUIREMENTS

A. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels; 2019.

B. ICC (IPC) - International Plumbing Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL 1453 - Standard for Electric Booster and Commercial Storage Tank Water Heaters; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Product Data:
   1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
   2. Provide electrical characteristics and connection requirements.

B. Shop Drawings:
   1. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.

C. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.6 WARRANTY

A. Provide 8 year manufacturer warranty for domestic water heaters.

PART 2 PRODUCTS

2.1 WATER HEATERS

A. Manufacturers:
   1. A.O. Smith Water Products Co: www.hotwater.com/#sle.
   2. Rheem Manufacturing Company: www.rheem.com/#sle.
   3. Bradford White.

B. Commercial Electric:
   1. Type: Factory-assembled and wired, electric, vertical storage.
   2. Performance:
   3. Electrical Characteristics:
   4. Tank: Glass lined welded steel; 4 inch (100 mm) diameter inspection port, thermally insulated with minimum 2 inches (50 mm) glass fiber encased in corrosion-resistant steel jacket; baked-on enamel finish.
   5. Controls: Automatic immersion water thermostat; externally adjustable temperature range from 60 to 180 degrees F (16 to 82 degrees C), flanged or screw-in nichrome elements, high temperature limit thermostat.
   6. Accessories:
   7. Heating Elements: Flange-mounted immersion elements; individual elements sheathed with Incoloy corrosion-resistant metal alloy, rated less than 75 W/sq in (11.6 W/sq m).

2.2 DIAPHRAGM-TYPE COMPRESSION TANKS

A. Manufacturers:
   1. Amtrol Inc: www.amtrol.com/#sle.

B. Construction: Welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; supplied with National Board Form U-1, rated for working pressure of 125 psig (860 kPa), with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.

C. Accessories: Pressure gauge and air-charging fitting, tank drain; precharge to 12 psig (80 kPa).

2.3 ELECTRICAL WORK

A. Provide electrical motor driven equipment specified complete with motors, motor starters, controls, and wiring.

B. Electrical characteristics to be as indicated.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.

B. Coordinate with plumbing piping and related fuel piping work to achieve operating system.

C. Domestic Water Storage Tanks:
   1. Provide steel pipe support, independent of building structural framing members.
   2. Clean and flush prior to delivery to site. Seal until pipe connections are made.
   3. Pipe relief valves and drains to nearest floor drain.

END OF SECTION

SECTION 22 4000 - PLUMBING FIXTURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Water closets.

B. Lavatories.

C. Mop sinks.

D. Under-lavatory pipe supply covers.

E. Electric water coolers.

F. Showers.

1.2 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ASME A112.18.9 - Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures; 2011 (Reaffirmed 2017).

C. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping; 2015.

D. ASHRAE Std 18 - Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration; 2013.

E. ASME A112.18.1 - Plumbing Supply Fittings; 2018.

F. ASME A112.18.9 - Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures; 2011 (Reaffirmed 2017).

G. ASME A112.19.2 - Ceramic Plumbing Fixtures; 2018.

H. ASME A112.19.3 - Stainless Steel Plumbing Fixtures; 2017.

I. ASME A112.19.5 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks; 2017.

J. ASSE 1070 - Performance Requirements for Water Temperature Limiting Devices; 2015.

K. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

L. NSF 61 - Drinking Water System Components - Health Effects; 2019.

M. NSF 372 - Drinking Water System Components - Lead Content; 2016.

1.3 SUBMITTALS

A. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

B. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Accept fixtures on site in factory packaging. Inspect for damage.

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.5 WARRANTY

A. Provide five year manufacturer warranty for electric water cooler.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.2 REGULATORY REQUIREMENTS

A. Comply with applicable codes for installation of plumbing systems.

2.3 FLUSH VALVE WATER CLOSETS

A. Water Closets: Vitreous china, ASME A112.19.2, wall hung, siphon jet flush action, china bolt caps.
   1. Flush Valve: Exposed (top spud).
   2. Flush Operation: Sensor operated.

3. Handle Height: 44 inches (1117 mm) or less.
4. Manufacturers:
   a. American Standard, Inc: www.americanstandard-us.com/#sle.

B. Flush Valves: ASME A112.18.1, diaphragm type, complete with vacuum breaker stops and accessories.
1. Sensor-Operated Type: Solenoid or motor-driven operator, low voltage hard-wired, infrared sensor with mechanical over-ride or over-ride push button.
2. Exposed Type: Chrome plated, escutcheon, integral screwdriver stop.

C. Seats:
1. Manufacturers:
   a. American Standard, Inc: www.americanstandard-us.com/#sle.
   b. Bemis Manufacturing Company: www.bemismfg.com/#sle.
   c. Church Seat Company: www.churchseats.com/#sle.
2. Solid white plastic, open front, extended back, self-sustaining hinge, brass bolts, without cover.

D. Water Closet Carriers:
1. Manufacturers:
   a. Jay R. Smith MFG. Co: www.jrsmith.com/#sle.
   b. JOSAM Company: www.josam.com/#sle.
   c. Zurn Industries, Inc: www.zurn.com/#sle.

2.4 LAVATORIES

A. Lavatory Manufacturers:
1. Kohler Company: www.kohler.com/#sle.

B. Vitreous China Under-Mount Basin: ASME A112.19.2; vitreous china under-mount lavatory, front overflow, mounting kit and template by manufacturer.

C. Sensor Operated Faucet: Cast brass, chrome plated, wall mounted with sensor located on neck of spout.
1. Spout Style: Standard.
2. Power Supply: Per manufacturer's requirements.
   a. Cord and plug.
   b. For 6V or 24V applications, provide transformer.
3. Mixing Valve: External lever operated.
4. Water Supply: 1/2 inch (13 mm) compression connections.
5. Aerator: Vandal resistant, 0.5 GPM (1.89 LPM), laminar flow device.
6. Finish: Polished chrome.

D. Thermostatic Mixing Valve: Thermostatic mixing valve, ASSE 1070 listed, with combination stop, strainer, and check valves, and flexible stainless steel connectors.

E. Accessories:
1. Offset waste with perforated open strainer.
2. Wheel handle stops.
3. Flexible supplies.

2.5 UNDER-LAVATORY PIPE SUPPLY COVERS

A. General:
1. Insulate exposed drainage piping including hot, cold and tempered water supplies under lavatories or sinks per ADA Standards.
2. Construction: 1/8 inch (3.2 mm) PVC with antimicrobial, antifungal and UV resistant properties.
   a. Comply with ASME A112.18.9 for covers on accessible lavatory piping.
   b. Comply with ICC A117.1.

2.6 SHOWERS

A. Shower Valve:
1. Comply with ASME A112.18.1.
2. Provide two way in-wall diverter valve body with integral thermostatic mixing valve to supply 1.5 gpm (0.094 L/s).

B. Low-Flow Shower Head:
1. ASME A112.18.1; chrome plated vandal-proof institutional head with integral wall bracket, built-in 1.5 gpm (0.094 L/s) flow control.

C. Thermostatic Mixing Valve: Thermostatic mixing valve, ASSE 1070 listed, with combination stop, strainer, and check valves, and flexible stainless steel connectors.

2.7 BI-LEVEL, ELECTRIC WATER COOLERS

A. Water Cooler: Bi-level, electric, mechanically refrigerated; surface mounted, ADA compliant; stainless steel top, vinyl on steel body, elevated anti-squirt bubbler with stream guard, automatic stream regulator, push button, mounting bracket; integral air cooled condenser and stainless steel grille.
   1. Capacity: 8 gallons per hour (30.3 liters per hour) of 50 degrees F (10 degrees C) water with inlet at 80 degrees F (27 degrees C) and room temperature of 90 degrees F (32 degrees C), when tested in accordance with ASHRAE Std 18.
   2. Electrical: 115 V, 60 Hertz compressor, 6 foot (2 m) cord and plug for connection to electric wiring system including grounding connector.

B. Bottle Filler: Materials to match fountain.

2.8 MOP SINKS

A. Mop Sink:

B. Material: Molded Stone

C. Type: Rectilinear, drop front.

D. Tiling Flange Construction: Galvanized steel.

E. Grid strainer: Stainless steel; integral; removable.

F. Dimensions: As indicated on drawings.

G. Accessories:
   1. 5 feet (1.5 m) of 1/2 inch (13 mm) diameter plain end reinforced plastic hose.
   2. Hose clamp hanger.
   3. Mop hanger.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

B. Verify that electric power is available and of the correct characteristics.

C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.2 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.

B. Install components level and plumb.

3.4 INTERFACE WITH WORK OF OTHER SECTIONS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.5 ADJUSTING

3.6 CLEANING

A. Clean plumbing fixtures and equipment.

3.7 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 23 0513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. General construction and requirements.

B. Applications.

C. Single phase electric motors.

D. Three phase electric motors.

E. Electronically Commutated Motors (ECM).

1.2 RELATED REQUIREMENTS

A. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. IEEE 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators; 2017.

B. NEMA MG 1 - Motors and Generators; 2018.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 SUBMITTALS

A. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.

1.5 QUALITY ASSURANCE

A. Comply with NFPA 70.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

PART 2 PRODUCTS

2.1 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Construction:
   1. Open drip-proof type except where specifically noted otherwise.
   2. Design for continuous operation in 104 degrees F (40 degrees C) environment.
   3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.

B. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.

C. Wiring Terminations:
   1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
   2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

2.2 APPLICATIONS

A. Exception: Motors less than 250 watts, for intermittent service may be the equipment manufacturer's standard and need not comply with these specifications.

B. Single phase motors for shaft mounted fans, oil burners, and centrifugal pumps: Split phase type.

C. Single phase motors for shaft mounted fans or blowers: Permanent split capacitor type.

2.3 SINGLE PHASE POWER - SPLIT PHASE MOTORS

A. Starting Torque: Less than 150 percent of full load torque.

B. Starting Current: Up to seven times full load current.

C. Breakdown Torque: Approximately 200 percent of full load torque.

D. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve or ball bearings.

2.4 SINGLE PHASE POWER - PERMANENT-SPLIT CAPACITOR MOTORS

A. Starting Torque: Exceeding one fourth of full load torque.

B. Starting Current: Up to six times full load current.

C. Multiple Speed: Through tapped windings.

D. Open Drip-proof or Enclosed Air Over Enclosure: Class A (50 degrees C temperature rise) insulation, minimum 1.0 Service Factor, prelubricated sleeve or ball bearings, automatic reset overload protector.

2.5 THREE PHASE POWER - SQUIRREL CAGE MOTORS

A. Starting Torque: Between 1 and 1-1/2 times full load torque.

B. Starting Current: Six times full load current.

C. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.

D. Design, Construction, Testing, and Performance: Comply with NEMA MG 1 for Design B motors.

E. Insulation System: NEMA Class B or better.

F. Testing Procedure: In accordance with IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.

G. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

C. Check line voltage and phase and ensure agreement with nameplate.

END OF SECTION

SECTION 23 0516 - EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe loops, offsets, and swing joints.

1.2 REFERENCE STANDARDS

A. EJMA (STDS) - EJMA Standards; Tenth Edition.

B. ITS (DIR) - Directory of Listed Products; current edition.

1.3 SUBMITTALS

A. Product Data:
   1. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.

PART 2 PRODUCTS

2.1 EXPANSION LOOPS - HOSE AND BRAID

A. Manufacturers:
   1. The Metraflex Company; Metraloop: www.metraflex.com/#sle.

B. Provide flexible loops with two flexible sections of hose and braid, two 90 degree elbows, and 180 degree return with support bracket and air release or drain plug.

C. Flexible Connectors: Flanged, braided type with wetted components of bronze, sized to match piping.
   1. Maximum Allowable Working Pressure: 150 psig (1030 kPa) at 120 degrees F (49 degrees C).
   2. End Connections: Same as specified for pipe jointing.
   3. Provide necessary accessories including, but not limited to, swivel joints.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with EJMA (Expansion Joint Manufacturers Association) Standards.

C. Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required.

END OF SECTION

SECTION 23 0517 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe sleeves.

B. Manufactured sleeve-seal systems.

1.2 REFERENCE STANDARDS

A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2016.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a (Reapproved 2017).

1.3 SUBMITTALS

A. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

1.4 QUALITY ASSURANCE

A. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.

B. Provide temporary protective coating on cast iron and steel sleeves if shipped loose.

PART 2 PRODUCTS

2.1 PIPE SLEEVES

A. Vertical Piping:
   1. Sleeve Length: 1 inch (25 mm) above finished floor.
   2. Provide sealant for watertight joint.

B. Sheet Metal: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.

C. Pipe Passing Mechanical Room Floors above Basement:
   1. Galvanized steel pipe or black iron pipe with asphalt coating.
   2. Connect sleeve with floor plate except in mechanical rooms.

D. Clearances:
   1. Provide allowance for insulated piping.
   2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch (25 mm) greater than external; pipe diameter.
   3. All Rated Openings: Caulked tight with fire stopping material in compliance with ASTM E814 in accordance with Section 07 8400 to prevent the spread of fire, smoke, and gases.

2.2 MANUFACTURED SLEEVE-SEAL SYSTEMS

A. Manufacturers:

B. Modular/Mechanical Seal:
   1. Synthetic rubber interlocking links continuously fill annular space between pipe and wall/casing opening.
   2. Provide watertight seal between pipe and wall/casing opening.
   3. Elastomer element size and material in accordance with manufacturer's recommendations.
   4. Glass reinforced plastic pressure end plates.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

3.2 INSTALLATION

A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

B. Install piping to conserve building space, to not interfere with use of space and other work.

C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

D. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
   1. Aboveground Piping:
      a. Pack solid using mineral fiber in compliance with ASTM C592.
      b. Fill space with an elastomer caulk to a depth of 0.50 inch (15 mm) where penetrations occur between conditioned and unconditioned spaces.

E. Manufactured Sleeve-Seal Systems:
   1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
   2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
   3. Locate piping in center of sleeve or penetration.
   4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
   5. Tighten bolting for a water-tight seal.
   6. Install in accordance with manufacturer's recommendations.

F. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.3 CLEANING

A. Upon completion of work, clean all parts of the installation.

B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

END OF SECTION

SECTION 23 0519 - METERS AND GAUGES FOR HVAC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pressure gauges and pressure gauge taps.

B. Thermometers and thermometer wells.

1.2 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2013.

B. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2014.

C. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers; 2014, with Editorial Revision (2017).

D. UL 393 - Indicating Pressure Gauges for Fire-Protection Service; Current Edition, Including All Revisions.

1.3 SUBMITTALS

A. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

PART 2 PRODUCTS

2.1 PRESSURE GAUGES

A. Manufacturers:
   1. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
   2. Moeller Instrument Company, Inc: www.moellerinstrument.com/#sle.
   3. Omega Engineering, Inc: www.omega.com/#sle.

B. Pressure Gauges: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.
   1. Case: Steel with brass bourdon tube.
   2. Size: 4-1/2 inch (115 mm) diameter.
   3. Mid-Scale Accuracy: One percent.
   4. Scale: Psi.

2.2 PRESSURE GAUGE TAPPINGS

A. Gauge Cock: Tee or lever handle, brass for maximum 150 psi (1034 kPa).

B. Needle Valve: Brass, 1/4 inch (6 mm) NPT for minimum 150 psi (1034 kPa).

2.3 STEM TYPE THERMOMETERS

A. Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.
   1. Size: 9 inch (225 mm) scale.
   2. Window: Clear Lexan.
   3. Stem: 3/4 inch (20 mm) NPT brass.
   4. Accuracy: 2 percent, per ASTM E77.
   5. Calibration: Degrees F.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide one pressure gauge per pump, installing taps before strainers and on suction and discharge of pump. Pipe to gauge.

C. Install pressure gauges with pulsation dampers. Provide gauge cock to isolate each gauge. Provide siphon on gauges in steam systems. Extend nipples and siphons to allow clearance from insulation.

D. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch (60 mm) for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

E. Provide instruments with scale ranges selected according to service with largest appropriate scale.

F. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

G. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

3.2 SCHEDULE

A. Pressure Gauges, Location:
   1. Pumps, []
   2. Expansion tanks, []
   3. Pressure reducing valves, []

B. Pressure Gauge Tappings, Location:
   1. Major coils - inlets and outlets.AHU hot water and chilled water coils.
   2. Heat exchangers - inlets and outlets.

C. Stem Type Thermometers, Location:
   1. Headers to central equipment.
   2. Heat exchangers - inlets and outlets.
   3. After major coils. .AHU hot water and chilled water coils.

END OF SECTION

SECTION 23 0529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Support and attachment components for equipment, piping, and other HVAC/hydronic work.

1.2 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.

1.3 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General - Purpose Piping; 2014.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2018).

F. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2015.

G. MFMA-4 - Metal Framing Standards Publication; 2004.

H. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 3000.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems, nonpenetrating rooftop supports, post-installed concrete and masonry anchors, and thermal insulated pipe supports.

B. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.
   1. Application of protective inserts, saddles, and shields at pipe hangers for each type of insulation and hanger.

1.6 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

PART 2 PRODUCTS

2.1 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
   2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.

3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
4. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
   a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
   b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
   1. Comply with MFMA-4.

C. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
   1. Minimum Size, Unless Otherwise Indicated or Required:
      a. Equipment Supports: 1/2 inch (13 mm) diameter.
      b. Piping up to 1 inch (27 mm) nominal: 1/4 inch (6 mm) diameter.
      c. Piping larger than 1 inch (27 mm) nominal: 3/8 inch (10 mm) diameter.
      d. Trapeze Support for Multiple Pipes: 3/8 inch (10 mm) diameter.

D. Beam Clamps: MSS SP-58 Types 19 through 23, 25 or 27 through 30 based on required load.
   1. Material: ASTM A36/A36M carbon steel or ASTM A181/A181M forged steel.
   2. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.

E. Riser Clamps:
   1. Provide copper plated clamps for copper tubing support.
   2. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.

F. Pipe Hangers: For a given pipe run, use hangers of the same type and material.
   1. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
   2. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.

G. Anchors and Fasteners:
   1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
   2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
   3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
   4. Hollow Masonry: Use toggle bolts.
   5. Hollow Stud Walls: Use toggle bolts.
   6. Steel: Use beam clamps.
   7. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
      a. Comply with MFMA-4.
      b. Channel Material: Use galvanized steel.
      c. Manufacturer: Same as manufacturer of metal channel (strut) framing system.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.

C. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

D. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

E. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

F. Equipment Support and Attachment:
   1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.

2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

G. Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.

H. Secure fasteners according to manufacturer's recommended torque settings.

I. Remove temporary supports.

3.3 FIELD QUALITY CONTROL

A. Inspect support and attachment components for damage and defects.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 23 0548 - VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Vibration isolation requirements.

B. Vibration-isolated equipment support bases.

C. Vibration isolators.

1.2 REFERENCE STANDARDS

A. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; Most Recent Edition Cited by Referring Code or Reference Standard.

B. MFMA-4 - Metal Framing Standards Publication; 2004.

1.3 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.
   1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification method for spring element load capacities.

B. Shop Drawings - Vibration Isolation Systems:
   1. Include dimensioned plan views and sections indicating proposed arrangement of vibration isolators; indicate equipment weights and static deflections.
   2. Vibration-Isolated Equipment Support Bases: Include base weights, including concrete fill where applicable; indicate equipment mounting provisions.

PART 2 PRODUCTS

2.1 VIBRATION-ISOLATED EQUIPMENT SUPPORT BASES

A. Manufacturers:
   1. Vibration-Isolated Equipment Support Bases:
      a. Mason Industries: www.mason-ind.com/#sle.

B. Vibration-Isolated Structural Steel Bases:
   1. Description: Engineered structural steel frames with integral mounting provisions for vibration isolators, sized and configured for mounting of equipment.

C. Vibration-Isolated Concrete Inertia Bases:
   1. Description: Concrete-filled engineered steel forms with integral mounting provisions for vibration isolators, sized and configured for mounting of equipment.
   2. Minimum Base Depth: 6 inches (152 mm).
   3. Minimum Base Mass (Including Concrete): 1.5 times weight of supported equipment.
   4. Concrete Reinforcement: Welded or tied reinforcing bars running both ways in a single layer.
   5. Concrete: Filled on site with minimum 3000 psi (20 mPa) concrete in accordance with Section 03 3000.

2.2 VIBRATION ISOLATORS

A. Manufacturers:
   1. Vibration-Isolated Equipment Support Bases:
      a. Mason Industries; _____: www.mason-ind.com/#sle.

B. General Requirements:
   1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.
   2. Spring Elements for Spring Isolators:
      a. Color code or otherwise identify springs to indicate load capacity.
      b. Lateral Stability: Minimum lateral stiffness to vertical stiffness ratio of 0.8.
      c. Designed to operate in the linear portion of their load versus deflection curve over deflection range of not less than 50 percent above specified deflection.
      d. Designed to provide additional travel to solid of not less than 50 percent of rated deflection at rated load.
      e. Selected to provide designed deflection of not less than 75 percent of specified deflection.
      f. Selected to function without undue stress or overloading.

C. Vibration Isolators for Non-Seismic Applications:
   1. Resilient Material Isolator Pads:

a. Description: Single or multiple layer pads utilizing elastomeric (e.g. neoprene, rubber) or fiberglass isolator material.
b. Pad Thickness: As required for specified minimum static deflection; minimum 0.25 inch (6 mm) thickness.
c. Multiple Layer Pads: Provide bonded, galvanized sheet metal separation plate between each layer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C. Secure fasteners according to manufacturer's recommended torque settings.

D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

END OF SECTION

SECTION 23 0553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe markers.

1.2 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2015.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2017.

1.3 SUBMITTALS

A. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

C. Product Data: Provide manufacturers catalog literature for each product required.

PART 2 PRODUCTS

2.1 IDENTIFICATION APPLICATIONS

A. Air Handling Units: Nameplates.

B. Air Terminal Units: Nameplates.

C. Automatic Controls: Tags. Key to control schematic.

D. Control Panels: Nameplates.

E. Heat Transfer Equipment: Nameplates.

F. Instrumentation: Tags.

G. Major Control Components: Nameplates.

H. Piping: Pipe markers.

I. Pumps: Nameplates.

J. Relays: Tags.

K. Small-sized Equipment: Tags.

L. Tanks: Nameplates.

M. Thermostats: Nameplates.

N. Valves: Tags.

2.2 NAMEPLATES

A. Manufacturers:
   1. Advanced Graphic Engraving, LLC: www.advancedgraphicengraving.com/#sle.
   2. Brimar Industries, Inc: www.pipemarker.com/#sle.

B. Letter Color: White.

C. Letter Height: 1/4 inch (6 mm).

D. Background Color: Black.

E. Plastic: Comply with ASTM D709.

2.3 TAGS

A. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch (40 mm) diameter with smooth edges.

B. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.4 PIPE MARKERS

A. Manufacturers:
   1. Brady Corporation: www.bradycorp.com/#sle.
   2. Seton Identification Products, a Tricor Company: www.seton.com/#sle.

B. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

C. Color code per Rowan Color Code Standards.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

END OF SECTION

SECTION 23 0593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Measurement of final operating condition of HVAC systems.

C. Sound measurement of equipment operating conditions.

D. Vibration measurement of equipment operating conditions.

E. Commissioning activities.

1.2 REFERENCE STANDARDS

A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition; 2016.

B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2008 (Reaffirmed 2017).

C. NEBB (TAB) - Procedural Standards for Testing Adjusting and Balancing of Environmental Systems; 2015, with Errata (2017).

D. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing; 2002.

1.3 SUBMITTALS

A. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
   1. Submit to Architect.
   2. Submit six weeks prior to starting the testing, adjusting, and balancing work.
   3. Include certification that the plan developer has reviewed Contract Documents, the equipment and systems, and the control system with the Architect and other installers to sufficiently understand the design intent for each system.
   4. Include at least the following in the plan:
      a. Preface: An explanation of the intended use of the control system.
      b. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
      c. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
      d. Identification and types of measurement instruments to be used and their most recent calibration date.
      e. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
      f. Final test report forms to be used.
      g. Detailed step-by-step procedures for TAB work for each system and issue, including:
         1 Terminal flow calibration (for each terminal type).
         2 Diffuser proportioning.
         3 Branch/submain proportioning.
         4 Total flow calculations.
         5 Rechecking.
         6 Diversity issues.
      h. Details of how TOTAL flow will be determined; for example:
         1 Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.
         2 Water: Pump curves, circuit setter, flow station, ultrasonic, etc.
      i. Specific procedures that will ensure that both air and water side are operating at the lowest possible pressures and methods to verify this.
      j. Confirmation of understanding of the outside air ventilation criteria under all conditions.
      k. Method of verifying and setting minimum outside air flow rate will be verified and set and for what level (total building, zone, etc.).
      l. Method of checking building static and exhaust fan and/or relief damper capacity.
      m. Proposed selection points for sound measurements and sound measurement methods.
      n. Time schedule for TAB work to be done in phases (by floor, etc.).
      o. Time schedule for deferred or seasonal TAB work, if specified.
      p. False loading of systems to complete TAB work, if specified.

q. Exhaust fan balancing and capacity verifications, including any required room pressure differentials.
r. Procedures for field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).
s. Procedures for formal deficiency reports, including scope, frequency and distribution.

B. Field Logs: Submit at least once a week to the Construction Manager.

C. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.

D. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
1. Submit to the the Construction Manager within two weeks after completion of testing, adjusting, and balancing.
2. Revise TAB plan to reflect actual procedures and submit as part of final report.
3. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
4. Provide reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
5. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
6. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
7. Units of Measure: Report data in I-P (inch-pound) units only.
8. Include the following on the title page of each report:
a. Name of Testing, Adjusting, and Balancing Agency.
b. Address of Testing, Adjusting, and Balancing Agency.
c. Telephone number of Testing, Adjusting, and Balancing Agency.
d. Project name.
e. Project location.
f. Project Architect.
g. Project Engineer.
h. Project Contractor.
i. Project altitude.
j. Report date.

E. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
1. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
2. SMACNA (TAB).

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

D. TAB Agency Qualifications:
1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
2. Certified by one of the following:
a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.
b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.
c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org/#sle.

E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.2 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
   1. Systems are started and operating in a safe and normal condition.
   2. Temperature control systems are installed complete and operable.
   3. Proper thermal overload protection is in place for electrical equipment.
   4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
   5. Duct systems are clean of debris.
   6. Fans are rotating correctly.
   7. Fire and volume dampers are in place and open.
   8. Air coil fins are cleaned and combed.
   9. Access doors are closed and duct end caps are in place.
   10. Air outlets are installed and connected.
   11. Duct system leakage is minimized.
   12. Hydronic systems are flushed, filled, and vented.
   13. Pumps are rotating correctly.
   14. Proper strainer baskets are clean and in place.
   15. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

3.3 PREPARATION

A. Hold a pre-balancing meeting at least one week prior to starting TAB work.

3.4 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.5 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:
   1. Running log of events and issues.
   2. Discrepancies, deficient or uncompleted work by others.
   3. Contract interpretation requests.
   4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. Mark on drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.6 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

G. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

H. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

I. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

J. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

K. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches (12.5 Pa) positive static pressure near the building entries.

L. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

M. On fan powered VAV boxes, adjust air flow switches for proper operation.

3.7 WATER SYSTEM PROCEDURE

A. Adjust water systems to provide required or design quantities.

B. Use calibrated fittings and pressure gages to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

D. Effect system balance with automatic control valves fully open to heat transfer elements.

E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

F. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.8 SCOPE

A. Test, adjust, and balance the following:
   1. HVAC Pumps.
   2. Heat Exchangers
   3. Air Coils.
   4. Terminal Heat Transfer Units.
   5. Air Handling Units.
   6. Fans.
   7. Air Filters.
   8. Air Terminal Units.
   9. Air Inlets and Outlets.

3.9 MINIMUM DATA TO BE REPORTED

A. Electric Motors:
   1. Manufacturer.
   2. Model/Frame.
   3. HP/BHP.
   4. Phase, voltage, amperage; nameplate, actual, no load.
   5. RPM.
   6. Service factor.
   7. Starter size, rating, heater elements.
   8. Sheave Make/Size/Bore.

B. V-Belt Drives:
   1. Identification/location.
   2. Required driven RPM.
   3. Driven sheave, diameter and RPM.
   4. Belt, size and quantity.
   5. Motor sheave diameter and RPM.
   6. Center to center distance, maximum, minimum, and actual.

C. Pumps:

1. Identification/number.
2. Manufacturer.
3. Size/model.
4. Impeller.
5. Service.
6. Design flow rate, pressure drop, BHP.
7. Actual flow rate, pressure drop, BHP.
8. Discharge pressure.
9. Suction pressure.
10. Total operating head pressure.
11. Shut off, discharge and suction pressures.
12. Shut off, total head pressure.

D. Heat Exchangers:
1. Identification/number.
2. Location.
3. Service.
4. Manufacturer.
5. Model number.
6. Serial number.
7. Steam pressure, design and actual.
8. Primary water entering temperature, design and actual.
9. Primary water leaving temperature, design and actual.
10. Primary water flow, design and actual.
11. Primary water pressure drop, design and actual.

E. Cooling Coils:
1. Identification/number.
2. Location.
3. Service.
4. Manufacturer.
5. Air flow, design and actual.
6. Entering air DB temperature, design and actual.
7. Entering air WB temperature, design and actual.
8. Leaving air DB temperature, design and actual.
9. Leaving air WB temperature, design and actual.
10. Water flow, design and actual.
11. Water pressure drop, design and actual.
12. Entering water temperature, design and actual.
13. Leaving water temperature, design and actual.
14. Saturated suction temperature, design and actual.
15. Air pressure drop, design and actual.

F. Heating Coils:
1. Identification/number.
2. Location.
3. Service.
4. Manufacturer.
5. Air flow, design and actual.
6. Water flow, design and actual.
7. Water pressure drop, design and actual.
8. Entering water temperature, design and actual.
9. Leaving water temperature, design and actual.
10. Entering air temperature, design and actual.
11. Leaving air temperature, design and actual.
12. Air pressure drop, design and actual.

G. Air Moving Equipment:
1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Arrangement/Class/Discharge.
6. Air flow, specified and actual.

7. Return air flow, specified and actual.
8. Outside air flow, specified and actual.
9. Total static pressure (total external), specified and actual.
10. Inlet pressure.
11. Discharge pressure.
12. Sheave Make/Size/Bore.
13. Number of Belts/Make/Size.
14. Fan RPM.

H. Return Air/Outside Air:
1. Identification/location.
2. Design air flow.
3. Actual air flow.
4. Design return air flow.
5. Actual return air flow.
6. Design outside air flow.
7. Actual outside air flow.
8. Return air temperature.
9. Outside air temperature.
10. Required mixed air temperature.
11. Actual mixed air temperature.
12. Design outside/return air ratio.
13. Actual outside/return air ratio.

I. Exhaust Fans:
1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Air flow, specified and actual.
6. Total static pressure (total external), specified and actual.
7. Inlet pressure.
8. Discharge pressure.
9. Sheave Make/Size/Bore.
10. Number of Belts/Make/Size.
11. Fan RPM.

J. Terminal Unit Data:
1. Manufacturer.
2. Type, constant, variable, single, dual duct.
3. Identification/number.
4. Location.
5. Model number.
6. Size.
7. Minimum static pressure.
8. Minimum design air flow.
9. Maximum design air flow.
10. Maximum actual air flow.
11. Inlet static pressure.

K. Air Distribution Tests:
1. Air terminal number.
2. Room number/location.
3. Terminal type.
4. Terminal size.
5. Area factor.
6. Design velocity.
7. Design air flow.
8. Test (final) velocity.
9. Test (final) air flow.
10. Percent of design air flow.

L. Sound Level Reports:
1. Location.

2. Octave bands - equipment off.
3. Octave bands - equipment on.

END OF SECTION

SECTION 23 0713 - DUCT INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Duct insulation.

B. Duct liner.

C. Insulation jackets.

1.2 RELATED REQUIREMENTS

A. Section 23 0553 - Identification for HVAC Piping and Equipment.

1.3 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

C. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2017.

D. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013.

E. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014.

F. ASTM C1410 - Standard Specification for Cellular Melamine Thermal and Sound-Absorbing Insulation; 2017.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.

H. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

I. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.2 GLASS FIBER, FLEXIBLE

A. Manufacturer:
   1. CertainTeed Corporation: www.certainteed.com/#sle.
   2. Johns Manville: www.jm.com/#sle.
   3. Knauf Insulation; Atmosphere Duct Wrap: www.knaufinsulation.com/#sle.
   4. Owens Corning Corporation: www.ocbuildingspec.com/#sle.

B. Insulation: ASTM C553; flexible, noncombustible blanket.
   1. K (Ksi) value: 0.25 at 75 degrees F (0.036 at 24 degrees C), when tested in accordance with ASTM C518. Final resistance shall be R-6
   2. Maximum Service Temperature: 450 degrees F (232 degrees C).
   3. Maximum Water Vapor Absorption: 5.0 percent by weight.

C. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Moisture Vapor Permeability: 0.02 perm inch (0.029 ng/Pa s m), when tested in accordance with ASTM E96/E96M.

2.3 GLASS FIBER, RIGID

A. Manufacturer:
   1. CertainTeed Corporation: www.certainteed.com/#sle.
   2. Johns Manville: www.jm.com/#sle.
   3. Knauf Insulation: www.knaufinsulation.com/#sle.
   4. Owens Corning Corporation: www.ocbuildingspec.com/#sle.

B. Insulation: ASTM C612; rigid, noncombustible blanket.
   1. K (Ksi) Value: [], when tested in accordance with ASTM C518. Final Ressistance shall be R-6, Outside ductwork shall be R-13 with weather resistant Jacket. Exposed ductwork shall be insulated with 1" rigid insulation to prevent condensation and painted with a coler selected by the architect.
   2. Maximum Service Temperature: 450 degrees F (232 degrees C).
   3. Maximum Water Vapor Absorption: 5.0 percent.

C. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Moisture Vapor Permeability: 0.02 perm inch (0.029 ng/Pa s m), when tested in accordance with ASTM E96/E96M.

2.4 JACKETS

A. Aluminum Jacket: ASTM B209 (ASTM B209M).
   1. Thickness: 0.016 inch (0.40 mm) sheet.
   2. Finish: Smooth.
   3. Joining: Longitudinal slip joints and 2 inch (50 mm) laps.
   4. Fittings: 0.016 inch (0.4 mm) thick die shaped fitting covers with factory attached protective liner.
   5. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.015 inch (0.38 mm) thick aluminum.

PART 3 EXECUTION

3.1 EXAMINATION

A. Test ductwork for design pressure prior to applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Insulated Ducts Conveying Air Below Ambient Temperature:
   1. Provide insulation with vapor barrier jackets.
   2. Finish with tape and vapor barrier jacket.
   3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
   4. Insulate entire system, including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

C. Insulated Ducts Conveying Air Above Ambient Temperature:
   1. Provide with vapor barrier jacket.
   2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

END OF SECTION

SECTION 23 0716 - HVAC EQUIPMENT INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Equipment insulation.

1.2 RELATED REQUIREMENTS

1.3 REFERENCE STANDARDS

A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019.

B. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2013).

C. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2017.

D. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013.

E. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2016.

F. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.

H. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

I. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for equipment scheduled.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.2 GLASS FIBER, RIGID

A. Manufacturer:
   1. CertainTeed Corporation: www.certainteed.com/#sle.
   2. Johns Manville Corporation: www.jm.com/#sle.
   3. Knauf Insulation; Earthwool Insulation Board: www.knaufinsulation.com/#sle.
   4. Owens Corning Corporation: www.ocbuildingspec.com/#sle.

B. Insulation: ASTM C612 or ASTM C592; rigid, noncombustible.
   1. K (Ksi) Value: 0.25 at 75 degrees F (0.036 at 24 degrees C), when tested in accordance with ASTM C177 or ASTM C518.
   2. Maximum Service Temperature: 850 degrees F (454 degrees C).
   3. Maximum Water Vapor Absorption: 5.0 percent by weight.
   4. Maximum Density: 8.0 lb/cu ft (128 kg/cu m).

C. Vapor Barrier Jacket:

1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability: 0.02 perm inch (0.029 ng/Pa s m), when tested in accordance with ASTM E96/E96M.
3. Secure with self-sealing longitudinal laps and butt strips.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that equipment has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Factory Insulated Equipment: Do not insulate.

C. Exposed Equipment: Locate insulation and cover seams in least visible locations.

D. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.

E. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.

F. Insulated equipment containing fluids below ambient temperature; insulate entire system.

G. For hot equipment containing fluids over 140 degrees F (60 degrees C), insulate flanges and unions with removable sections and jackets.

3.3 SCHEDULE

A. Heating Systems:
   1. Heat Exchangers/Converters:
   2. Air Separators:
   3. Expansion Tanks:

B. Cooling Systems:
   1. Pump Bodies:
   2. Air Separators:
   3. Expansion Tanks:

END OF SECTION

SECTION 23 0719 - HVAC PIPING INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.2 REFERENCE STANDARDS

A. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; 2018.

B. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019.

C. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2017.

D. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2018).

E. ASTM D610 - Standard Practice for Evaluating Degree of Rusting on Painted Steel Surfaces; 2008 (Reapproved 2012).

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.

G. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

H. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.3 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.2 GLASS FIBER, RIGID

A. Manufacturers:
   1. CertainTeed Corporation: www.certainteed.com/#sle.
   2. Johns Manville Corporation: www.jm.com/#sle.
   3. Knauf Insulation; Earthwool 1000 Degree Pipe Insulation: www.knaufinsulation.com/#sle.
   4. Owens Corning Corporation; Fiberglas Pipe Insulation ASJ: www.ocbuildingspec.com/#sle.

B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
   1. K (Ksi) Value: ASTM C177, 0.24 at 75 degrees F (0.035 at 24 degrees C).
   2. Maximum Service Temperature: 850 degrees F (454 degrees C).
   3. Maximum Moisture Absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches (0.029 ng/Pa s m).

2.3 ACCESSORIES

A. General Requirements:
   1. Provide required accessories in accordance with and subject to the recommendations of the insulation manufacturer.
   2. Furnish compatible materials which do not contribute to corrosion, soften, or otherwise attack surfaces to which applied, in either the wet or dry state.
   3. Comply with ASTM C795 requirements for materials to be used on stainless steel surfaces.
   4. Supply materials that are asbestos free.

B. Corrosion Inhibitors:
   1. Corrosion Control Gel:
      a. Corrosion Protection: Comply with ASTM B117 and ASTM D610.

PART 3 EXECUTION

3.1 EXAMINATION

A. Test piping for design pressure, liquid tightness, and continuity prior to applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions. Insulation thickness must meet the requirements of the 2018 International Energy Conservation Code.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated Pipes Conveying Fluids Below Ambient Temperature:
   1. Insulate entire system, including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

E. Glass Fiber Insulated Pipes Conveying Fluids Below Ambient Temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied; secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. For hot piping conveying fluids over 140 degrees F (60 degrees C), insulate flanges and unions at equipment.

G. Glass Fiber Insulated Pipes Conveying Fluids Above Ambient Temperature:
   1. Provide standard jackets, with or without vapor barrier, factory-applied, or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

H. Inserts and Shields:
   1. Application: Piping 1-1/2 inches (40 mm) diameter or larger.
   2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
   3. Insert location: Between support shield and piping and under the finish jacket.
   4. Insert Configuration: Minimum 6 inches (150 mm) long, of same thickness and contour as adjoining insulation; may be factory fabricated.
   5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

I. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 8400.

J. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping. Provide two coats of UV resistant finish for flexible elastomeric cellular insulation without jacketing.

3.3 SCHEDULE

A. Heating Systems:
   1. Heating Water Supply and Return:
   2. Glycol Heating Supply and Return:

B. Cooling Systems:
   1. Chilled Water:
   2. Heat Recovery Water:

END OF SECTION

SECTION 23 0923 - DIRECT DIGITAL CONTROL SYSTEM FOR HVAC (WEBSN4)

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Building Management System (BMS), utilizing direct digital controls. (WEBsN4)

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Products Supplied but Not Installed Under This Section:
   1. Control valves.
   2. Flow switches.

B. Products Installed but Not Supplied Under This Section:
   1. None.

C. Products Not Furnished or Installed but Integrated with the Work of This Section:
   1. Smoke detectors (through alarm relay contacts).

D. Work Required Under Other Divisions Related to This Section:
   1. Power wiring to line side of motor starters, disconnects or variable frequency drives.
   2. Provision and wiring of smoke detectors and other devices relating to fire alarm system.
   3. Campus LAN (Ethernet) connection adjacent to JACE network management controller.

1.3 SYSTEM DESCRIPTION

A. Scope: Furnish all labor, materials and equipment necessary for a complete and operating Building Management System (BMS), utilizing Direct Digital Controls as shown on the drawings and as described herein. Drawings are diagrammatic only. All controllers furnished in this section shall communicate on a peer-to-peer bus over an open protocol bus (Examples: LonTalk, BACnet, MODBUS).
   1. The intent of this specification is to provide a system that is consistent with BMS systems throughout the owner's facilities running the Niagara 4 Framework.
   2. System architecture shall fully support a multi-vendor environment and be able to integrate third party systems via existing vendor protocols including, as a minimum, LonTalk, BACnet and MODBUS.
   3. System architecture shall provide secure Web access using any of the current versions of Microsoft Internet Explorer, Mozilla Firefox, or Google Chrome browsers from any computer on the owner's LAN.
   4. All control devices furnished with this Section shall be programmable directly from the Niagara 4 Workbench embedded toolset upon completion of this project. The use of configurable or programmable controllers that require additional software tools for post-installation maintenance shall not be acceptable.
   5. Any control vendor that shall provide additional BMS server software shall be unacceptable. Only systems that utilize the Niagara 4 Framework shall satisfy the requirements of this section.
   6. The BMS server shall host all graphic files for the control system. All graphics and navigation schemes for this project shall match those that are on the existing campus NiagaraAX or Niagara 4 Framework server.
   7. Owner shall receive all Administrator level login and passwords for engineering toolset at first training session. The Owner shall have full licensing and full access rights for all network management, operating system server, engineering and programming software required for the ongoing maintenance and operation of the BMS.
   8. OPEN NIC STATEMENTS - All Niagara 4 software licenses shall have the following NiCS: "accept.station.in=*"; "accept.station.out=*"and "accept.wb.in=*"and "accept.wb.out=*". All open NIC statements shall follow Niagara Open NIC specifications.
   9. All JACE hardware licenses and certificates shall be stored on local MicroSD memory card employing encrypted "safe boot" technology.
   10. To ensure quality, any JACE 3E, 6E, or 7 hardware products used on this project shall come through the Tridium Richmond, VA shipping facility. JACE hardware products not meeting this requirement will not be allowed.

B. All products of the BMS shall be provided with the following agency approvals. Verification that the approvals exist for all submitted products shall be provided on request, with the submittal package. Systems or products not currently offering the following approvals are not acceptable.
   1. Federal Communications Commission (FCC), Rules and Regulations, Volume II -July 1986 Part 15 Class A Radio Frequency Devices.
   2. FCC, Part 15, Subpart B, Class B
   3. FCC, Part 15, Subpart C
   4. FCC, Part 15, Subpart J, Class A Computing Devices.
   5. UL 504 - Industrial Control Equipment.

6. UL 506 - Specialty Transformers.
7. UL 910 - Test Method for Fire and Smoke Characteristics of Electrical and Optical-Fiber Cables Used in Air-Handling Spaces.
8. UL 916 - Energy Management Systems All.
9. UL 1449 - Transient Voltage Suppression.
10. Standard Test for Flame Propagation Height of Electrical and Optical - Fiber Cables Installed Vertically in Shafts.
11. EIA/ANSI 232-E - Interface Between Data Technical Equipment and Data Circuit Terminal Equipment Employing Serial Binary Data Interchange.
12. EIA 455 - Standard Test Procedures for Fiber Optic Fibers, Cables, Transducers, Connecting and Terminating Devices.
13. IEEE C62.41- Surge Voltages in Low-Voltage AC Power Circuits.
14. IEEE 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.
    a. NEMA 250 - Enclosures for Electrical Equipment.
15. NEMA ICS 1 - Industrial Controls and Systems.
16. NEMA ST 1 - Specialty Transformers.
17. NCSBC Compliance, Energy: Performance of control system shall meet or surpass the requirements of ASHRAE/IESNA 90.1-1999.
18. CE 61326.
19. C-Tick.
20. cUL.

1.4 SPECIFICATION NOMENCLATURE

A. Acronyms used in this specification are as follows:
1. Actuator: Control device that opens or closes valve or damper in response to control signal.
2. AI: Analog Input.
3. AO: Analog Output.
4. Analog: Continuously variable state over stated range of values.
5. AUC: Advanced Unitary Controller.
6. BCT: BACnet Touchscreen Communicating Thermostat.
7. BMS: Building Management System.
8. DDC: Direct Digital Control.
9. Discrete: Binary or digital state.
10. DI: Discrete Input.
11. DO: Discrete Output.
12. FC: Fail Closed position of control device or actuator. Device moves to closed position on loss of control signal or energy source.
13. FO: Fail open (position of control device or actuator). Device moves to open position on loss of control signal or energy source.
14. GUI: Graphical User Interface.
15. HMI: Human Machine Interface.
16. HVAC: Heating, Ventilating and Air Conditioning.
17. IDC: Interoperable Digital Controller.
18. ILC: Interoperable Lon Controller.
19. LAN: Local Area Network.
20. Modulating: Movement of a control device through an entire range of values, proportional to an infinitely variable input value.
21. Motorized: Control device with actuator.
22. NAC: Network Area Controller.
23. NC: Normally closed position of switch after control signal is removed or normally closed position of manually operated valves or dampers.
24. NO: Normally open position of switch after control signal is removed; or the open position of a controlled valve or damper after the control signal is removed; or the usual position of a manually operated valve.
25. OSS: Operating System Server, host for system graphics, alarms, trends, etc.
26. Operator: Same as actuator.
27. PC: Personal Computer.
28. Peer-to-Peer: Mode of communication between controllers in which each device connected to network has equal status and each shares its database values with all other devices connected to network.
29. P: Proportional control; control mode with continuous linear relationship between observed input signal and final controlled output element.

30. PI: Proportional-Integral control, control mode with continuous proportional output plus additional change in output based on both amount and duration of change in controller variable (reset control).
31. PICS: BACnet Product Interoperability Compliance Statement.
32. PICU: Programmable IP Control Unit.
33. PID: Proportional-Integral-Derivative control, control mode with continuous correction of final controller output element versus input signal based on proportional error, its time history (reset) and rate at which it's changing (derivative).
34. Point: Analog or discrete instrument with addressable database value.
35. PPCU: Programmable Plant Control Unit.
36. UICU: Unitary IP Control Unit.
37. WAN: Wide Area Network.

1.5 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

B. Submit documentation of contractor qualifications, including those indicated in "Quality Assurance" if requested by the A-E.

C. Electronic set of shop drawings in PDF format of the entire control system shall be submitted and shall consist of a complete list of equipment and materials, including manufacturers' catalog data sheets and installation instructions. Submit in printed electronic format. Samples of written Controller Checkout Sheets and Performance Verification Procedures for applications similar in scope shall be included for approval.

D. Shop drawings shall also contain complete wiring and schematic diagrams, sequences of operation, control system bus layout and any other details required to demonstrate that the system has been coordinated and will properly function as a system. Terminal identification for all control wiring shall be shown on the shop drawings.

E. Upon completion of the work, provide 3 complete sets of ' as-built' drawings and other project-specific documentation in 3-ring hard-backed binders and on Flash media.

F. Any deviations from these specifications or the work indicated on the drawings shall be clearly identified in the Submittals.

1.6 QUALITY ASSURANCE

A. The Control System Contractor shall have a full service DDC office within 50 miles of the job site. It is preferable that **multiple** contractor bids **using the same manufacturer** be provided. The office shall be staffed with applications engineers, software engineers and field technicians. This office shall maintain parts inventory and shall have all testing and diagnostic equipment necessary to support this work, as well as staff trained in the use of this equipment.

B. Single Source Responsibility of Supplier: The Control System Contractor shall be responsible for the complete installation and proper operation of the control system. The Control System Contractor shall exclusively be in the regular and customary business of design, installation and service of computerized building management systems similar in size and complexity to the system specified. The Control System Contractor shall be the manufacturer of the primary DDC system components or shall have been the authorized representative for the primary DDC components manufacturer for at least 5 years. All control panels shall be assembled by the Control System Contractor in a UL-Certified 508A panel shop.

C. Equipment and Materials: Equipment and materials shall be cataloged products of manufacturers regularly engaged in the production and installation of HVAC control systems. Products shall be manufacturer's latest standard design and have been tested and proven in actual use.

1.7 PRE-INSTALLATION MEETINGS

A. Convene minimum two weeks prior to starting work of this section.

1.8 DELIVERY, STORAGE AND HANDLING

A. Maintain integrity of shipping cartons for each piece of equipment and control device through shipping, storage and handling as required to prevent equipment damage. Store equipment and materials inside and protected from weather.

1.9 JOB CONDITIONS

A. Cooperation with Other Trades: Coordinate the Work of this section with that of other sections to insure that the Work will be carried out in an orderly fashion. It shall be this Contractor's responsibility to check the

Contract Documents for possible conflicts between his Work and that of other crafts in equipment location, pipe, duct and conduit runs, electrical outlets and fixtures, air diffusers and structural and architectural features.

1.10 SEQUENCING

A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Honeywell Building Technologies, which is located at: 715 Peachtree St. NE, Atlanta, GA 30308; Toll Free Tel: 888-793-8193; Email:request info (buildingcontrols@honeywell.com); Web:buildingcontrols.honeywell.com. Only Honeywell registered WEBs Contractors are acceptable as defined as:
   1. Authorized Controls Integrator (ACI Direct, ACI Elite or ACI)
   2. Building Control Specialist (BCS)

B. Substitutions: Not permitted

2.2 GENERAL

A. The Building Management System (BMS) shall be comprised of a network of interoperable, stand-alone digital controllers, a network area controller, graphics and programming and other control devices for a complete system as specified herein.

B. The installed system shall provide secure password access to all features, functions and data contained in the overall BMS.

2.3 OPEN, INTEROPERABLE, INTEGRATED ARCHITECTURE

A. The intent of this specification is to provide a peer-to-peer networked, stand-alone, distributed control system utilizing Open protocols in one open, interoperable system.

B. The supplied computer software shall employ object-oriented technology (OOT) for representation of all data and control devices within the system. Physical connection of any BACnet control equipment, such as chillers, shall be via Ethernet or IP.

C. All components and controllers supplied under this contract shall be true "peer-to-peer" communicating devices. Components or controllers requiring "polling" by a host to pass data shall not be acceptable.

D. The supplied system shall incorporate the ability to access all data using HTML5 enabled browsers without requiring proprietary operator interface and configuration programs or browser plug-ins. An Open Database Connectivity (ODBC) or Structured Query Language (SQL) compliant server database is required for all system database parameter storage. This data shall reside on the Operating System Server located in the Facilities Office on the LAN. Systems requiring proprietary database and user interface programs shall not be acceptable.

E. A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer's internal Intranet network. Systems employing a "flat" single tiered architecture shall not be acceptable.
   1. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 5 seconds for network connected user interfaces.
   2. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 60 seconds for remote or dial-up connected user interfaces.

2.4 BAS SERVER HARDWARE (OWNER'S EXISTING – NEW SERVER NOT REQUIRED)

A. Integrate new systems installed under this contract into existing BAS Server.

2.5 SYSTEM NETWORK CONTROLLER (SNC)

A. These controllers are designed to manage communications between the Programmable IP Control Units (PICU), Programmable Plant Control Units (PPCU), Unitary IP Control Unit (UICU), Advanced Unitary Controllers (AUC), and BACnet Touchscreen Communication Thermostats (BCT) which are connected to its communications trunks or directly on the IP network, manage communications between itself and other system network controllers (SNC), PICUs, PPCUs, UICUs, and with any operator workstations (OWS) that are part of the BAS, and perform control and operating strategies for the system based on information from any controller connected to the BAS.

B. The controllers shall be fully programmable to meet the unique requirements of the facility it shall control.

C. The controllers shall be capable of peer-to-peer communications with other SNC's, PICUs, PPCUs, UICUs, and with any OWS connected to the BAS, whether the OWS is directly connected, connected via cellular modem or connected via the Internet.

D. The communication protocols utilized for peer-to-peer communications between SNC's will be Niagara 4 FoxS, BACnet TCP/IP and SNMP. Use of a proprietary communication protocol for peer-to-peer communications between SNC's is not allowed.

E. The SNC shall employ a device count capacity license model that supports expansion capabilities.

F. The SNC shall be enabled to support and shall be licensed with the following Open protocol drivers (client and server) by default:
   1. BACnet
   2. Lon
   3. MODBUS
   4. SNMP
   5. KNX

G. The SNC shall be capable of executing application control programs to provide:
   1. Calendar functions.
   2. Scheduling.
   3. Trending.
   4. Alarm monitoring and routing.
   5. Time synchronization.
   6. Integration of LonWorks, BACnet, and MODBUS controller data.
   7. Network management functions for all SNC, PICU, PPCU, UICU, AUC and BCT based devices.

H. The SNC shall provide the following hardware features as a minimum:
   1. Two 10/100 Mbps Ethernet ports.
   2. Two Isolated RS-485 ports with biasing switches.
   3. 1 GB RAM
   4. 4 GB Flash Total Storage / 2 GB User Storage
   5. Wi-Fi (Client or WAP)
   6. USB Flash Drive
   7. High Speed Field Bus Expansion
   8. -20-60 degrees C Ambient Operating Temperature
   9. Integrated 24 VAC/DC Global Power Supply
   10. MicroSD Memory Card Employing Encrypted Safe Boot Technology

I. The SNC shall support standard Web browser access via the Intranet/Internet. It shall support a minimum of 16 simultaneous users.

J. The SNC shall provide alarm recognition, storage, routing, management and analysis to supplement distributed capabilities of equipment or application specific controllers.

K. The SNC shall be able to route any alarm condition to any defined user location whether connected to a local network or remote via cellular modem, or wide-area network.
   1. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but not limited to:
      a. Alarm.
      b. Return to normal.
      c. To default.
   2. Alarms shall be annunciated in any of the following manners as defined by the user:
      a. Screen message text.
      b. Email of complete alarm message to multiple recipients.
      c. Pagers via paging services that initiate a page on receipt of email message.
      d. Graphics with flashing alarm object(s).
   3. The following shall be recorded by the SNC for each alarm (at a minimum):
      a. Time and date.
      b. Equipment (air handler #, access way, etc.).
      c. Acknowledge time, date, and user who issued acknowledgement.

L. Programming software and all controller "Setup Wizards" shall be embedded into the SNC.

M. The SNC shall support the following security functions.
   1. Module code signing to verify the author of programming tool and confirm that the code has not been altered or corrupted.
   2. Role-Based Access Control (RBAC) for managing user roles and permissions.

3. Require users to use strong credentials.
4. Data in Motion and Sensitive Data at Rest be encrypted.
5. LDAP and Kerberos integration of access management.

N. The SNC shall support the following data modeling structures to utilize Search; Hierarchy; Template; and Permission functionality:
1. Metadata: Descriptive tags to define the structure of properties.
2. Tagging: Process to apply metadata to components
3. Tag Dictionary

O. The SNC shall employ template functionality. Templates are a containerized set of configured data tags, graphics, histories, alarms... that are set to be deployed as a unit based upon manufacturer's controller and relationships. All lower level communicating controllers (PICU, PPCU, UICU, AUC) shall have an associated template file for reuse on future project additions.

P. The SNC shall be provided with a One Year Software Maintenance license. Labor to implement not included.

2.6 UNITARY IP CONTROL UNIT (UICU)

A. HVAC UICU controllers shall be fully programmable to meet the unique requirements of the HVAC equipment it shall control. The controller platform shall provide options and advanced system functions, programmable and configurable using Niagara 4 Framework, that allow standard and customizable control solutions required in executing the "Sequence of Operation".

B. All UICUs shall be application programmable and shall always maintain their certification. All control sequences within or programmed into the UICU shall be stored in non-volatile memory, which is not dependent upon the presence of a battery to be retained.

C. The controllers shall be capable of daisy-chain IP communications with other UICU's and peer-to-peer communications with SNC's and with any OWS connected to the BAS, whether the OWS is directly connected, connected via cellular modem or connected via the Internet.

D. The communication protocols utilized for peer-to-peer communications between UICU's will be Niagara 4 FoxS or BACnet TCP/IP. Use of a proprietary communication protocol for peer-to-peer communications between UICU's is not allowed.

E. The UICU shall be licensed and enabled to support three (3) devices and shall be licensed with the following Open protocol drivers by default:
1. BACnet IP
2. Modbus
3. SNMP

F. The UICU shall be provided with Lifetime Software Maintenance license. Labor to implement not included.

G. The UICU shall be capable of executing application control programs to provide:
1. Calendar functions.
2. Scheduling.
3. Trending.
4. Alarm monitoring and routing.
5. Time synchronization.
6. Integration of all daisy-chain UICU's.
7. Network management functions for all daisy-chain UICU's.

H. Programming software shall be embedded into the UICU. The UICU shall not require any external configuration tool or programming tool. All configuration and programming tasks shall be accomplished and accessible from within the embedded Niagara 4 environment.

I. The UICU shall support the following security functions.
1. Module code signing to verify the author of programming tool and confirm that the code has not been altered or corrupted.
2. Role-Based Access Control (RBAC) for managing user roles and permissions.
3. Require users to use strong credentials.
4. Data in Motion and Sensitive Data at Rest be encrypted.
5. Encrypted (PKI) Secure IP Stack Communication Security.
6. FIPS 140-2 Level 1 Cryptographic Module Compliant.

J. The minimum controller Environmental ratings.
1. Operating Temperature Ambient Rating: -4 degrees to 140 degrees F (-20 degrees to 60 degrees C).
2. Storage Temperature Ambient Rating: -40 degrees to 185 degrees F (-40 degrees to 85 degrees C).

K. The controller shall have the additional approval requirements, listings, and approvals:
1. Meets FCC Part 15, Class B (radiated emissions) requirements.

2. C-UL
3. CE
4. UL916, Open Energy Management Class 2
5. RoHS2
6. REACH
7. WEEE
8. CAN/CSA-C22.2 No. 205-12
9. The controller housing shall be UL plenum rated mounting to either a panel or DIN rail (2.40" x 7.04" x 4.53"; 61mm x 179mm x 115mm).

L. The UICU shall provide the following hardware features as a minimum:
1. The UICU shall provide LED indication of Power, Fault, Ethernet TX/RX/Traffic/Speed without cover removal.
2. ARM Cortex-A9/M4 9, 800 MHz
3. 512 MB DDR SDRAM
4. 2 GB Flash Memory
5. Powered from 24VAC/DC source
6. Two 10/100 MB Ethernet ports capable of daisy chaining
7. 1 RS-485 Serial Port
8. Real Time Clock
9. Secure Boot
10. Ten [10] onboard IO points
11. Supports up to 3 devices or 50 Points

M. The UICU shall support standard Web browser access via the Intranet/Internet.

N. The UICU shall be able to route any alarm condition to any defined user location whether connected to a local network or wide-area network.
1. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but not limited to:
   a. Alarm.
   b. Return to normal.
   c. To default.
2. Alarms shall be annunciated in any of the following manners as defined by the user:
   a. Screen message text.
   b. Email of complete alarm message to multiple recipients.
   c. Pagers via paging services that initiate a page on receipt of email message.
   d. Graphics with flashing alarm object(s).
3. The following shall be recorded by the UICU for each alarm (at a minimum):
   a. Time and date.
   b. Equipment (air handler #, access way, etc.).
   c. Acknowledge time, date, and user who issued acknowledgement.

O. UICU Controllers shall support at minimum the following control techniques:
1. General-purpose control loops that can incorporate Demand Limit Control strategies, Set point reset, adaptive intelligent recovery, and time of day bypass.
2. General-purpose, non-linear control loops.
3. Start/stop Loops.
4. If/Then/Else logic loops.
5. Math Function loops (MIN, MAX, AVG, SUM, SUB, SQRT, MUL, DIV, ENTHALPY).

P. The following five [5] Universal Inputs shall be supported per each UICU:
1. Type 3 10K Thermistor
2. 0-100K ohm
3. 0-10 VDC
4. 0-20mA with external resistor
5. Dry Contact

Q. The following two [2] Analog Outputs shall be supported per each UICU:
1. 0-10VDC, 4mA max output current

R. The following three [3] Digital Outputs shall be supported per each UICU:
1. Triac, 24VAC @ 0.5 amp

S. The UICU shall employ a 50 Point Base License that supports one [1] IO-R-34 expansion module over a shielded RS-485 bus or three [3] devices via the embedded protocols.

T. Each UICU shall have expansion ability to support additional I/O requirements through the use of a remote input/output module connected to an RS-485 local communication bus. Each UICU shall be able to support a maximum of one [1] 34 Point Expansion I/O Modules for a maximum of 44 physical I/O points.
   1. 34 Point Mixed Expansion I/O Module shall communicate with UICU via a 2-wire RS-485m bus.
   2. Sixteen [16] Universal Inputs shall be supported via 34 Point Expansion I/O Module:
      a. Type 3 10K Thermistor
      b. 0-100K ohm
      c. 0-10 VDC
      d. 0-20mA with external resistor
   3. Eight [8] Analog Outputs shall be supported via 34 Point Expansion I/O Module:
      a. 0-10.0 Vdc
   4. Ten [10] Digital Outputs (Relay) shall be supported via 34 Point Expansion I/O Module:
      a. Form A Contacts, 24 VAC at 0.5 A rated

U. The UICU shall not include an integrated Local Operator Interface.

2.7 ADVANCED UNITARY CONTROLLER (AUC)

A. The advanced unitary controller (AUC) platform shall be designed specifically to control HVAC - ventilation, filtration, heating, cooling, humidification, and distribution. Equipment includes: constant volume air handlers, VAV air handlers, packaged RTU, heat pumps, unit vents, fan coils, natural convection units and radiant panels. The control shall use BACnet based devices where the application has a BTL Listed PICS defined. The controller platform shall provide options and advanced system functions, programmable and configurable, using Niagara 4 Framework, that allow standard and customizable control solutions required in executing the "Sequence of Operation".

B. Minimum Requirements:
   1. The controller shall be fully programmable or configurable with full functionality on any Niagara 4 brand platform.
      a. Support downloads to the controller in Niagara 4 platform.
      b. Support uploads from the controller to Niagara 4 platform.
      c. Support simulation/debug mode of the controller.
      d. Maintain native GUI.
      e. Native function-block programming software and all controller "Setup Wizards" shall be embedded within the Niagara 4 environment.
   2. The AUC shall be capable of either integrating with other devices or stand-alone operation.
   3. For VAV box applications, the AUC shall have an internal velocity pressure sensor.
      a. Sensor Type: Microbridge air flow sensor with dual integral restrictors.
      b. Operating Range: 0 to 1.5 inch H2O (0 to 374 Pa).
      c. Accuracy: +/- 2% of full scale at 32 degrees to 122 degrees F (0 degrees to 50 degrees C); +/- 1% of full scale at null pressure.
   4. The AUC shall have two microprocessors. The Host processor contains on-chip FLASH program memory, FLASH information memory, and RAM to run the main HVAC application. The second processor for network communications. Controller memory minimum requirements include:
      a. FLASH Memory Capacity: 60 Kilobytes with 8 Kilobytes for application program.
      b. FLASH Memory settings retained for ten years.
      c. RAM: 2 Kilobytes.
   5. The AUC shall have an internal time clock with the ability to automatically revert from a master time clock on failure.
      a. Operating Range: 24 hour, 365 day, multi-year calendar including day of week and configuration for automatic day-light savings time adjustment to occur on configured start and stop dates.
      b. Accuracy: +/- 1 minute per month at 77 degrees F (25 degrees C).
      c. Power Failure Backup: 24 hours at 32 degrees to 122 degrees F (0 degrees to 50 degrees C).
   6. The AUC shall have Significant Event Notification, Periodic Update capability, and Failure Detect when network inputs fail to be detected within their configurable time frame.
   7. The AUC shall have an internal DC power supply to power external sensors.
      a. Power Output: 20 VDC +/- 10% at 75 mA.
   8. The AUC shall have a visual indication (LED) of the status of the devise:
      a. Controller operating normally.
      b. Controller in process of download.
      c. Controller in manual mode under control of software tool.
      d. Controller lost its configuration.
      e. No power to controller, low voltage, or controller damage.
      f. Processor and/or controller are not operating.

9. The minimum AUC Environmental ratings.
    a. Operating Temperature Ambient Rating: -40 degrees to 150 degrees F (-40 degrees to 65.5 degrees C) for an AUC in unconditioned space.
    b. Storage Temperature Ambient Rating: -40 degrees to 150 degrees F (-40 degrees to 65.5 degrees C) for an AUC in unconditioned space.
    c. Operating Temperature Ambient Rating: 32 degrees to 122 degrees F (0 degrees to 50 degrees C) for an AUC in conditioned space.
    d. Storage Temperature Ambient Rating: 32 degrees to 122 degrees F (0 degrees to 50 degrees C) for an AUC in conditioned space.
    e. Relative Humidity: 5% to 95% non-condensing.
10. The AUC shall have the additional approval requirements, listings, and approvals:
    a. UL/cUL (E87741) listed under UL916 (Standard for Open Energy Management Equipment) with plenum rating.
    b. CSA (LR95329-3) Listed.
    c. Meets FCC Part 15, Subpart B, Class B (radiated emissions) requirements.
    d. Meets Canadian standard C108.8 (radiated emissions).
    e. Conforms requirements European Consortium standard EN 61000-6-1; 2001 (EU Immunity).
    f. Conforms requirements European Consortium standard EN 61000-6-3; 2001 (EU Emission).
11. The AUC housing shall be UL plenum rated mounting to either a panel or DIN rail (standard EN50022; 7.5mm x 35mm).
12. For VAV box applications, the AUC shall provide an integrated actuator option.
    a. Actuator type: Series Floating.
    b. Rotation stroke: 95 degrees +/- 177;3 degrees for CW or CCW opening dampers.
    c. Torque rating: 44 lb-inch (5 Nm).
    d. Run time for 90 degree rotation: 90 seconds at 60 Hz.
13. The AUC shall have a mix of Universal Inputs (UI), Digital Inputs (DI), Analog Outputs (AO), and Digital Triac Outputs (DO), as well as a 2-wire, polarity insensitive, AUC communication bus providing Sensor, Actuator, and I/O expandability.
    a. Analog outputs (AO) shall be capable of being configured as digital outputs (DO).
    b. Input and Output wiring terminal strips shall be removable from the controller without disconnecting wiring.
    c. Input and Output wiring terminals shall be designated with color coded labels.
    d. Universal inputs shall be capable of being configured as binary inputs, resistive inputs, voltage inputs (0-10 VDC), or current inputs (4-20 mA).
14. The AUC shall provide "continuous" automated loop tuning with an Adaptive Integral Algorithm Control Loop.
15. The AUC platform shall have standard HVAC application programs that are modifiable to support both the traditional and specialized "sequence of operations" as outlined in Section 4.
    a. Discharge air control and low limit.
    b. Pressure-dependent dual duct without flow mixing.
    c. Variable air volume with return flow tracking.
    d. Economizer with differential enthalpy.
    e. Minimum airflow coordinated with CO2.
    f. Unit ventilator cycle (1, 2, 3) 2-pipe.
    g. Unit ventilator cycle (1, 2, 3) 2-pipe with face/bypass.
    h. Unit ventilator cycle (1, 2, 3) 4-pipe.
    i. Unit ventilator cycle (1, 2, 3) 4-pipe with EOC valve.
    j. VAV terminal unit.
    k. VAV terminal unit fan speed control.
    l. Series fan.
    m. Parallel fan.
    n. Regulated air volume (room pressurization/de-pressurization).
    o. CV dual-duct.
    p. Room CO2 control.
    q. Room Humidity.
    r. TOD occupancy sensor stand-by set points.

2.8 OTHER CONTROL SYSTEM HARDWARE

A. Motorized control dampers that will not be integral to the equipment shall be furnished by the Control System Contractor. Control damper frames shall be constructed of galvanized steel, formed into changes and welded or riveted. Dampers shall be galvanized, with nylon bearings. Blade edge seals shall be vinyl. Blade edge and tip seals shall be included for all dampers. Blades shall be 16-gauge minimum and 6 inches wide

maximum and frame shall be of welded channel iron. Damper leakage shall not exceed 10 CFM per square foot, at 1.5 inches water gauge static pressure. Honeywell is basis of design.

B. Control damper actuators shall be furnished by the Control System Contractor. Two-position or proportional electric actuators shall be direct-mount type sized to provide a minimum of 5 in-lb torque per square foot of damper area. Damper actuators shall be spring return type. Operators shall be heavy-duty electronic type for positioning automatic dampers in response to a control signal. Motor shall be of sufficient size to operate damper positively and smoothly to obtain correct sequence as indicated. All applications requiring proportional operation shall utilize truly proportional electric actuators. Honeywell is basis of design.

C. Control Valves: Control valves shall be 2-way pattern as shown and constructed for tight shutoff at the pump shut-off head or steam relief valve pressure. Control valves shall operate satisfactorily against system pressures and differentials. Two-position valves shall be ' line' size. Proportional control valves shall be sized for a maximum pressure drop of 5.0 psi at rated flow (unless otherwise noted or scheduled on the drawings). Valves with sizes up to and including 2 inches (51 mm) shall be "screwed" configuration and 2-1/2 inches (63.5 mm) and larger valves shall be "flanged" configuration. All control valves, including terminal unit valves, less than 2 inches (51 mm) shall be globe valves. Electrically-actuated control valves shall include spring return type actuators sized for tight shut-off against system pressures (as specified above) and, when specified, shall be furnished with integral switches for indication of valve position (open-closed). Pneumatic actuators for valves, when utilized, shall be sized for tight shut-off against system pressures (as specified above). Honeywell is basis of design.

D. Control Valve Actuators: Actuators for VAV terminal unit heating coils shall be "drive-open; drive-closed" type. All actuators shall have inherent current limiting motor protection. Valve actuators shall be 24-volt, electronic type, modulating or two-position as required for the correct operating sequence. Actuators on valves needing ' fail-safe' operation shall have spring return to Normal position. Modulating valves shall be positive positioning in response to the signal. All valve actuators shall be UL listed. Honeywell is basis of design.

E. All control valves 2-1/2 inches (63.5 mm) or larger shall have position indication. All hot water control valves shall be Normally-Open arrangement; all chilled water control valves shall be Normally-Closed arrangement. Honeywell is basis of design.

F. Wall Mount Room Temperature sensors: Each room temperature sensor shall provide temperature indication to the digital controller, provide the capability for a software-limited occupant set point adjustment (warmer-cooler slider bar or switch) and limited operation override capability. Room Temperature Sensors shall be 20,000-ohm thermistor type with a temperature range of -40 to 140 degrees F (-38 to 60 degrees C). The sensor shall be complete with a decorative cover and suitable for mounting over a standard electrical utility box. These devices shall have an accuracy of 0.5 degrees F (.024 degrees C) over the entire range. Honeywell is basis of design.

G. Duct-mounted and Outside Air Temperature Sensors: 20,000-ohm thermistor temperature sensors with an accuracy of ±; 0.2 degrees C. Outside air sensors shall include an integral sun shield. Duct-mounted sensors shall have an insertion measuring probe of a length appropriate for the duct size, with a temperature range of -40 to 160 degrees F(-38 to 71 degrees C) The sensor shall include a utility box and a gasket to prevent air leakage and vibration noise. For all mixed air and preheat air applications, install bendable averaging duct sensors with a minimum 8 feet (2438 mm) long sensor element. These devices shall have accuracy of 0.5 degrees F (.024 degrees C) over the entire range. Honeywell is basis of design.

H. Humidity sensors shall be thin-film capacitive type sensor with on-board nonvolatile memory, accuracy to plus or minus two percent (2%) at 0 to 90% RH, 12 - 30 VDC input voltage, analog output (0 - 10 VDC or 4 - 20mA output). Operating range shall be 0 to 100% RH and 32 to 140 degrees F (0 to 60 degrees C). Sensors shall be selected for wall, duct or outdoor type installation as appropriate. Honeywell is basis of design.

I. Carbon Dioxide Sensors (CO2): Sensors shall utilize Non-dispersive infrared technology (N.D.I.R.), repeatable to plus or minus 20 PPM. Sensor range shall be 0 - 2000 PPM. Accuracy shall be plus or minus five percent (5%) or 75 PPM, whichever is greater. Response shall be less than one minute. Input voltage shall be 20 to 30 VAC or DC. Output shall be 0 - 10 VDC. Sensor shall be wall or duct mounted type, as appropriate for the application, housed in a high impact plastic enclosure. Honeywell is basis of design.

J. Current Sensitive Switches: Solid state, split core current switch that operates when the current level (sensed by the internal current transformer) exceeds the adjustable trip point. Current switch to include an integral LED for indication of trip condition and a current level below trip set point. Honeywell is basis of design.

K. Differential Analog (duct) Static Pressure Transmitters Provide a pressure transmitter with integral capacitance type sensing and solid-state circuitry. Accuracy shall be plus or minus 1% of full range; range shall be selected for the specific application. Provide zero and span adjustment capability. Device shall have integral static pickup tube. Honeywell is basis of design.

L. Differential Air Pressure Switches: Provide SPDT type, UL-approved, and selected for the appropriate operating range where applied. Switches shall have adjustable set points and barbed pressure tips. Honeywell is basis of design.

M. Water Flow Switches: Provide a SPST type contact switch with bronze paddle blade, sized for the actual pipe size at the location. If installed outdoors, provide a NEMA-4 enclosure. Flow switch shall be UL listed.

N. Temperature Control Panels: Furnish temperature control panels of code gauge steel with locking doors for mounting all devices as shown. All electrical devices within a control panel shall be factory wired. Control panel shall be assembled by the BMS in a UL-Certified 508A panel shop. A complete set of ' as-built' control drawings (relating to the controls within that panel) shall be furnished within each control panel.

O. Pipe and Duct Temperature sensing elements: 20,000-ohm thermistor temperature sensors with and accuracy of ±1% accuracy. Their range shall be -5 to 250 degrees F (-20 to 121 degrees C). Limited range sensors shall be acceptable provided they are capable of sensing the range expected for the point at the specified accuracy. Thermal wells with heat conductive gel shall be included. Honeywell is basis of design.

P. Low Air Temperature Sensors: Provide SPST type switch, with 15 to 55 degrees F (-9 to 13 degrees C), range, vapor-charged temperature sensor. Honeywell model L482A, or approved equivalent.

Q. Variable Frequency Drives: The variable frequency drive (VFD) shall be designed specifically for use in Heating, Ventilation, and Air Conditioning (HVAC) applications in which speed control of the motor can be applied. The VFD, including all factory installed options, shall have UL & CSA approval. VFD's shall include communications capability with DDC BMS via built-in interface card (MODBUS or BACnet). Honeywell SmartVFD is basis of design.

R. Relays: Start/stop relay model shall provide either momentary or maintained switching action as appropriate for the motor being started. All relays shall be plugged in, interchangeable, mounted on a sub base and wired to numbered terminals strips. Relays installed in panels shall all be DPDT with indicating lamp. Relays installed outside of controlled devices shall be enclosed in a NEMA enclosure suitable for the location. Relays shall be labeled with UR symbol. RIB-style relays are acceptable for remote enable/disable.

S. Transducers: Differential pressure transducers shall be electronic with a 4-20 mA output signal compatible to the Direct Digital Controller. Wetted parts shall be stainless steel. Unit shall be designed to operate in the pressure ranges involved.

T. Control Power Transformers: Provide step-down transformers for all DDC controllers and devices as required. Transformers shall be sized for the load, but shall be sized for 50 watts, minimum. Transformers shall be UL listed Class 2 type, for 120 VAC/24 VAC operation. Honeywell is basis of design.

U. Line voltage protection: All DDC system control panels that are powered by 120 VAC circuits shall be provided with surge protection. This protection is in addition to any internal protection provided by the manufacturer. The protection shall meet UL, ULC 1449, IEEE C62.41B. A grounding conductor, (minimum 12 AWG), shall be brought to each control panel.

2.9 BAS SERVER & WEB BROWSER GUI - SYSTEM OVERVIEW

A. The BAS Contractor shall provide system software based on server/thin-client architecture, designed around the open standards of web technology. The BAS server shall communicate using Ethernet and TCP. Server shall be accessed using a web browser over Owner intranet and remotely over the Internet.

B. The intent of the thin-client architecture is to provide the operator(s) complete access to the BAS system via a web browser. The thin-client web browser Graphical User Interface (GUI) shall be browser and operating system agnostic, meaning it will support HTML5 enabled browsers without requiring proprietary operator interface and configuration programs or browser plug-ins. Microsoft, Firefox, and Chrome browsers (current released versions), and Windows as well as non-Window operating systems.

C. The BAS server software shall support at least the following server platforms (Windows 7, 8.1, Server 12). The BAS server software shall be developed and tested by the manufacturer of the system stand-alone controllers and network controllers/routers.

D. The web browser GUI shall provide a completely interactive user interface and shall provide a HTML5 experience that supports the following features as a minimum:
   1. Trending.
   2. Scheduling.
   3. Electrical demand limiting.
   4. Duty Cycling.
   5. Downloading Memory to field devices.
   6. Real time 'live' Graphic Programs.
   7. Tree Navigation.
   8. Parameter change of properties.
   9. Set point adjustments.
   10. Alarm / event information.
   11. Configuration of operators.
   12. Execution of global commands.

13. Add, delete, and modify graphics and displayed data.

E. Software Components: All software shall be the most current version. All software components of the BAS system software shall be provided and installed as part of this project. BAS software components shall include:
   1. Server Software, Database and Web Browser Graphical User Interface.
   2. One Year Software Maintenance license. Labor to implement not included.
   3. Embedded System Configuration Utilities for future modifications to the system and controllers.
   4. Embedded Graphical Programming Tools.
   5. Embedded Direct Digital Control software.
   6. Embedded Application Software.

F. BAS Server Database: The BAS server software shall utilize a Java Database Connectivity (JDBC) compatible database such as: MS SQL 8.0, Oracle 8i or IBM DB2. BAS systems written to Non -Standard and/or Proprietary databases are NOT acceptable.

G. Thin Client - Web Browser Based: The GUI shall be thin client or browser based and shall meet the following criteria:
   1. Web Browser's for PC's: Only the current released browser (Explorer/Firefox/Chrome) will be required as the GUI and a valid connection to the server network. No installation of any custom software shall be required on the operator's GUI workstation/client. Connection shall be over an intranet or the Internet.
   2. Secure Socket Layers: Communication between the Web Browser GUI and BAS server shall offer encryption using 128-bit encryption technology within Secure Socket Layers (SSL). Communication protocol shall be Hyper-Text Transfer Protocol (HTTP).

2.10 WEB BROWSER GRAPHICAL USER INTERFACE

A. Web Browser Navigation: The Thin Client web browser GUI shall provide a comprehensive user interface. Using a collection of web pages, it shall be constructed to "feel" like a single application, and provide a complete and intuitive mouse/menu driven operator interface. It shall be possible to navigate through the system using a web browser to accomplish requirements of this specification. The Web Browser GUI shall (as a minimum) provide for navigation, and for display of animated graphics, schedules, alarms/events, live graphic programs, active graphic set point controls, configuration menus for operator access, reports and reporting actions for events.

B. Login: On launching the web browser and selecting the appropriate domain name or IP address, the operator shall be presented with a login page that will require a login name and strong password. Navigation in the system shall be dependent on the operator's role-based application control privileges.

C. Navigation: Navigation through the GUI shall be accomplished by clicking on the appropriate level of a navigation tree (consisting of an expandable and collapsible tree control like Microsoft's Explorer program) and/or by selecting dynamic links to other system graphics. Both the navigation tree and action pane shall be displayed simultaneously, enabling the operator to select a specific system or equipment and view the corresponding graphic. The navigation tree shall as a minimum provide the following views: Geographic, Network, Groups and Configuration.
   1. Geographic View shall display a logical geographic hierarchy of the system including: cities, sites, buildings, building systems, floors, equipment and objects.
   2. Groups View shall display Scheduled Groups and custom reports.
   3. Configuration View shall display all the configuration categories (Operators, Schedule, Event, Reporting and Roles).

D. Action Pane: The Action Pane shall provide several functional views for each subsystem specified. A functional view shall be accessed by clicking on the corresponding button:
   1. Graphics: Using graphical format suitable for display in a web browser, graphics shall include aerial building/campus views, color building floor-plans, equipment drawings, active graphic set point controls, web content and other valid HTML elements. The data on each graphic page shall automatically refresh.
   2. Dashboards: User customizable data using drag and drop HTML5 elements. Shall include Web Charts, Gauges, and other custom developed widgets for web browser. User shall have ability to save custom dashboards.
   3. Search: User shall have multiple options for searching data based upon Tags. Associated equipment, real time data, Properties, and Trends shall be available in result.
   4. Properties: Shall include graphic controls and text for the following: Locking or overriding objects, demand strategies, and any other valid data required for setup. Changes made to the properties pages shall require the operator to depress an 'accept/cancel' button.
   5. Schedules: Shall be used to create, modify/edit and view schedules based on the systems hierarchy (using the navigation tree).

6. Alarms: Shall be used to view alarm information geographically (using the navigation tree), acknowledge alarms, sort alarms by category, actions and verify reporting actions.
7. Charting: Shall be used to display associated trend and historical data, modify colors, date range, axis and scaling. User shall have ability to create HTML charts through web browser without utilizing chart builder. User shall be able to drag and drop single or multiple data points, including schedules, and apply status colors for analysis.
8. Logic - Live Graphic Programs: Shall be used to display' live' graphic programs of the control algorithm, (micro block programming) for the mechanical/electrical system selected in the navigation tree.
9. Other actions such as Print, Help, Command, and Logout shall be available via a drop-down window.

E. Color Graphics: The Web Browser GUI shall make extensive use of color in the graphic pane to communicate information related to set points and comfort. Animated .gifs or .jpg, vector scalable, active set point graphic controls shall be used to enhance usability. Graphics tools used to create Web Browser graphics shall be non-proprietary and conform to the following basic criteria:
   1. Display Size: The GUI workstation software shall graphically display in a minimum of 1024 by 768 pixels 24 bit True Color.
   2. General Graphic: General area maps shall show locations of controlled buildings in relation to local landmarks.
   3. Color Floor Plans: Floor plan graphics shall show heating and cooling zones throughout the buildings in a range of colors, as selected by Owner. Provide a visual display of temperature relative to their respective set points. The colors shall be updated dynamically as a zone's actual comfort condition changes.
   4. Mechanical Components: Mechanical system graphics shall show the type of mechanical system components serving any zone through the use of a pictorial representation of components. Selected I/O points being controlled or monitored for each piece of equipment shall be displayed with the appropriate engineering units. Animation shall be used for rotation or moving mechanical components to enhance usability. .
   5. Minimum System Color Graphics: Color graphics shall be selected and displayed via a web browser for the following:
      a. Each piece of equipment monitored or controlled including each terminal unit.
      b. Each building.
      c. Each floor and zone controlled.

F. Hierarchical Schedules: Utilizing the Navigation Tree displayed in the web browser GUI, an operator (with proper access credentials) shall be able to define a Normal, Holiday or Override schedule for an individual piece of equipment or room, or choose to apply a hierarchical schedule to the entire system, site or floor area. For example, Independence Day ' Holiday' for every level in the system would be created by clicking at the top of the geographic hierarchy defined in the Navigation Tree. No further operator intervention would be required and every control module in the system with would be automatically downloaded with the ' Independence Day' Holiday. All schedules that affect the system/area/equipment highlighted in the Navigation Tree shall be shown in a summary schedule table and graph.
   1. Schedules: Schedules shall comply with the LonWorks and BACnet standards, (Schedule Object, Calendar Object, Weekly Schedule property and Exception Schedule property) and shall allow events to be scheduled based on:
      a. Types of schedule shall be Normal, Holiday or Override.
      b. A specific date.
      c. A range of dates.
      d. Any combination of Month of Year (1-12, any), Week of Month (1-5, last, any), Day of Week (M-Sun, Any).
      e. Wildcard (example, allow combinations like second Tuesday of every month).
   2. Schedule Categories: The system shall allow operators to define and edit scheduling categories (different types of "things" to be scheduled; for example, lighting, HVAC occupancy, etc.). The categories shall include: name, description, icon (to display in the hierarchy tree when icon option is selected) and type of value to be scheduled.
   3. Schedule Groups: In addition to hierarchical scheduling, operators shall be able to define functional Schedule Groups, comprised of an arbitrary group of areas/rooms/equipment scattered throughout the facility and site. For example, the operator shall be able to define an ' individual tenant' group - who may occupy different areas within a building or buildings. Schedules applied to the ' tenant group' shall automatically be downloaded to control modules affecting spaces occupied by the ' tenant group'.
   4. Intelligent Scheduling: The control system shall be intelligent enough to automatically turn on any supporting equipment needed to control the environment in an occupied space. If the operator schedules an individual room in a VAV system for occupancy, for example, the control logic shall

automatically turn on the VAV air handling unit, chiller, boiler and/or any other equipment required to maintain the specified comfort and environmental conditions within the room.

5. Partial Day Exceptions: Schedule events shall be able to accommodate a time range specified by the operator (ex: board meeting from 6 pm to 9 pm overrides Normal schedule for conference room).
6. Schedule Summary Graph: The schedule summary graph shall clearly show Normal versus Holiday versus Override Schedules and the net operating schedule that results from all contributing schedules. Note: In case of priority conflict between schedules at the different geographic hierarchy, the schedule for the more detailed geographic level shall apply.

G. Alarms: Alarms associated with a specific system, area, or equipment selected in the Navigation Tree, shall be displayed in the Action Pane by selecting an ' Alarms' view. Alarms, and reporting actions shall have the following capabilities:
   1. Alarms View: Each Alarm shall display an Alarms Category (using a different icon for each alarm category), date/time of occurrence, current status, alarm report and a bold URL link to the associated graphic for the selected system, area or equipment. The URL link shall indicate the system location, address and other pertinent information. An operator shall easily be able to sort events, edit event templates and categories, acknowledge or force a return to normal in the Events View as specified in this section.
   2. Alarm Categories: The operator shall be able to create, edit or delete alarm categories such as HVAC, Maintenance, Fire, or Generator. An icon shall be associated with each alarm category, enabling the operator to easily sort through multiple events displayed.
   3. Alarm Templates: Alarm template shall define different types of alarms and their associated properties. As a minimum, properties shall include a reference name, verbose description, severity of alarm, acknowledgement requirements, and high/low limit and out of range information.
   4. Alarm Areas: Alarm Areas enable an operator to assign specific Alarm Categories to specific Alarm Reporting Actions. For example, it shall be possible for an operator to assign all HVAC Maintenance Alarm on the 1st floor of a building to email the technician responsible for maintenance. The Navigation Tree shall be used to setup Alarm Areas in the Graphic Pane.
   5. Alarm Time/Date Stamp: All events shall be generated at the DDC control module level and comprise the Time/Date Stamp using the standalone control module time and date.
   6. Alarm Configuration: Operators shall be able to define the type of Alarm generated per object. A ' network' view of the Navigation Tree shall expose all objects and their respective Alarm Configuration. Configuration shall include assignment of Alarm, type of Acknowledgement and notification for return to normal or fault status.
   7. Alarm Summary Counter: The view of Alarm in the Graphic Pane shall provide a numeric counter, indicating how many Alarms are active (in alarm), require acknowledgement and total number of Alarms in the BAS Server database.
   8. Alarm Auto-Deletion: Alarms that are acknowledged and closed shall be auto-deleted from the database and archived to a text file after an operator defined period.
   9. Alarm Reporting Actions: Alarm Reporting Actions specified shall be automatically launched (under certain conditions) after an Alarm is received by the BAS server software. Operators shall be able to easily define these Reporting Actions using the Navigation Tree and Graphic Pane through the web browser GUI. Reporting Actions shall be as follows:
      a. Print: Alarm information shall be printed to the BAS server's PC or a networked printer.
      b. Email: Email shall be sent via any POP3-compatible e-mail server (most Internet Service Providers use POP3). Email messages may be copied to several email accounts. Note: Email reporting action shall also be used to support alphanumeric paging services, where email servers support pagers.
      c. File Write: The ASCII File write reporting action shall enable the operator to append operator defined alarm information to any alarm through a text file. The alarm information that is written to the file shall be completely definable by the operator. The operator may enter text or attach other data point information (such as AHU discharge temperature and fan condition upon a high room temperature alarm).
      d. Write Property: The write property reporting action updates a property value in a hardware module.
      e. SNMP: The Simple Network Management Protocol (SNMP) reporting action sends an SNMP trap to a network in response to receiving an alarm.
      f. Run External Program: The Run External Program reporting action launches specified program in response to an event.

H. Trends: As system is engineered, all points shall be enabled to trend. Trends shall both be displayed and user configurable through the Web Browser GUI. Trends shall comprise analog, digital or calculated points simultaneously. A trend log's properties shall be editable using the Navigation Tree and Graphic Pane.

1. Viewing Trends: The operator shall have the ability to view trends by using the Navigation Tree and selecting a Trends button in the Graphic Pane. The system shall allow y- and x-axis maximum ranges to be specified and shall be able to simultaneously graphically display multiple trends per graph.
2. Local Trends: Trend data shall be collected locally by Multi-Equipment/Single Equipment general-purpose controllers, and periodically uploaded to the BAS server if historical trending is enabled for the object. Trend data, including run time hours and start time date shall be retained in non-volatile module memory. Systems that rely on a gateway/router to run trends are NOT acceptable.
3. Resolution. Sample intervals shall be as small as one second. Each trended point will have the ability to be trended at a different trend interval. When multiple points are selected for displays that have different trend intervals, the system will automatically scale the axis.
4. Dynamic Update. Trends shall be able to dynamically update at operator-defined intervals.
5. Zoom/Pan. It shall be possible to zoom-in on a particular section of a trend for more detailed examination and ' pan through' historical data by simply scrolling the mouse.
6. Numeric Value Display. It shall be possible to pick any sample on a trend and have the numerical value displayed.
7. Copy/Paste. The operator shall have the ability to pan through a historical trend and copy the data viewed to the clipboard using standard keystrokes (i.e. CTRL+C, CTRL+V).

I. Security Access: Systems that are accessed from the web browser GUI to BAS server shall require a Login Name and Strong Password. Access to different areas of the BAS system shall be defined in terms of Role-Based Access Control privileges as specified:
   1. Roles: Roles shall reflect the actual roles of different types of operators. Each role shall comprise a set of ' easily understood English language' privileges. Roles shall be defined in terms of View, Edit and Function Privileges.
      a. View Privileges shall comprise: Navigation, Network, and Configuration Trees, Operators, Roles and Privileges, Alarm/Event Template and Reporting Action.
      b. Edit Privileges shall comprise: Set point, Tuning and Logic, Manual Override, and Point Assignment Parameters.
      c. Function Privileges shall comprise: Alarm/Event Acknowledgement, Control Module Memory Download, Upload, Schedules, Schedule Groups, Manual Commands, Print and Alarm/Event Maintenance.
   2. Geographic Assignment of Roles: Roles shall be geographically assigned using a similar expandable/collapsible navigation tree. For example, it shall be possible to assign two HVAC Technicians with similar competencies (and the same operator defined HVAC Role) to different areas of the system.

2.11 GRAPHICAL PROGRAMMING

A. The system software shall include a Graphic Programming Language (GPL) for all DDC control algorithms resident in all control modules. Any system that does not use a drag and drop method of graphical icon programming shall not be accepted. All systems shall use a GPL method used to create a sequence of operations by assembling graphic microblocks that represent each of the commands or functions necessary to complete a control sequence. Microblocks represent common logical control devices used in conventional control systems, such as relays, switches, high signal selectors etc., in addition to the more complex DDC and energy management strategies such as PID loops and optimum start. Each microblock shall be interactive and contain the programming necessary to execute the function of the device it represents.

B. Graphic programming shall be performed while on screen and using a mouse; each microblock shall be selected from a microblock library and assembled with other microblocks necessary to complete the specified sequence. Microblocks are then interconnected on screen using graphic "wires," each forming a logical connection. Once assembled, each logical grouping of microblocks and their interconnecting wires then forms a graphic function block which may be used to control any piece of equipment with a similar point configuration and sequence of operation.

C. Graphic Sequence: The clarity of the graphic sequence shall be such that the operator has the ability to verify that system programming meets the specifications, without having to learn or interpret a manufacturer's unique programming language. The graphic programming shall be self-documenting and provide the operator with an understandable and exact representation of each sequence of operation.

D. GPL Capabilities: The following is a minimum definition of the capabilities of the Graphic Programming software:
   1. Function Block (FB): Shall be a collection of points, microblocks and wires which have been connected together for the specific purpose of controlling a piece of HVAC equipment or a single mechanical system.
   2. Logical I/O: Input/Output points shall interface with the control modules in order to read various signals and/or values or to transmit signal or values to controlled devices.

3. Microblocks: Shall be software devices that are represented graphically and may be connected together to perform a specified sequence. A library of microblocks shall be submitted with the control contractors bid.
4. Wires: Shall be Graphical elements used to form logical connections between microblocks and between logical I/O.
5. Reference Labels: Labels shall be similar to wires in that they are used to form logical connections between two points. Labels shall form a connection by reference instead of a visual connection, i.e. two points labeled 'A' on a drawing are logically connected even though there is no wire between them.
6. Parameter: A parameter shall be a value that may be tied to the input of a microblock.
7. Properties: Dialog boxes shall appear after a microblock has been inserted which has editable parameters associated with it. Default parameter dialog boxes shall contain various editable and non-editable fields, and shall contain 'push buttons' for the purpose of selecting default parameter settings.
8. Icon: An icon shall be graphic representation of a software program. Each graphic microblock has an icon associated with it that graphically describes its function.
9. Menu-bar Icon: Shall be an icon that is displayed on the menu bar on the GPL screen, which represents its associated graphic microblock.
10. Live Graphical Programs: The Graphic Programming software shall support a ' live' mode, where all input/output data, calculated data and set points shall be displayed in a ' live' real-time mode.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 GENERAL

A. Install system and materials in accordance with manufacturer's instructions, and as detailed on the project drawing set.

B. Line and low voltage electrical connections to control equipment shown specified or shown on the control diagrams shall be furnished and installed by the Control System Contractor in accordance with these specifications.

C. Equipment furnished by the Mechanical Contractor that is normally wired before installation shall be furnished completely wired. Control wiring normally performed in the field will be furnished and installed by the Control System Contractor.

D. All control devices mounted on the face of control panels shall be clearly identified as to function and system served with permanently engraved phenolic labels.

3.4 WIRING

A. All electrical control wiring to the control panels shall be the responsibility of the Control System Contractor.

B. All wiring shall be in accordance with the Project Electrical Specifications (Division 16), the National Electrical Code and any applicable local codes. All control wiring shall be installed in raceways.

C. Excess wire shall not be looped or coiled in the controller cabinet.

D. Incorporate electrical noise suppression techniques in relay control circuits.

E. There shall be no drilling on the controller cabinet after the controls are mounted inside.

F. Careful stripping of wire while inside the cabinet is required to ensure that no wire strand fragments land on circuit boards.

G. Use manufacturer-specified wire for all network connections.

H. Use approved optical isolation and lightning protection when penetrating building envelope.

I. Read installation instructions carefully. Any unavoidable deviations shall be approved by owner's rep prior to installation.

3.5 ACCEPTANCE TESTING

A. Upon completion of the installation, the Control System Contractor shall load all system software and start-up the system. The Control System Contractor shall perform all necessary calibration, testing and de-bugging and perform all required operational checks to insure that the system is functioning in full accordance with these specifications.

B. The Control System Contractor shall perform tests to verify proper performance of components, routines and points. Repeat tests until proper performance results. This testing shall include a point-by-point log to validate 100% of the input and output points of the DDC system operation.

C. System Acceptance: Satisfactory completion is when the Control System Contractor has performed successfully all the required testing to show performance compliance with the requirements of the Contract Documents to the satisfaction of the Owner's Representative. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

3.6 OPERATOR TRAINING

A. During system commissioning and at such time acceptable performance of the Control System hardware and software has been established, the Control System Contractor shall provide on-site operator instruction to the owner's operating personnel. Operator instruction shall be done during normal working hours and shall be performed by a competent representative familiar with the system hardware, software and accessories.

B. The Control System Contractor shall provide 48 total hours of comprehensive training in multiple sessions for system orientation, product maintenance and troubleshooting, programming and engineering. These classes are to be spread out during the 1st year warranty period. The first class starting after final commissioning and the last class is to be in the last month of 1-year warranty period.

3.7 WARRANTY PERIOD SERVICES

A. Equipment, materials and workmanship incorporated into the work shall be warranted for a period of one year from the time of system acceptance.

B. Within this period, upon notice by the Owner, any defects in the BMS due to faulty materials, methods of installation or workmanship shall be promptly repaired or replaced by the Control System Contractor at no expense to the Owner.

C. Maintenance of Computer Software Programs: The Control System Contractor shall maintain all software during the standard first year warranty period. In addition, all factory or sub-vendor upgrades to software during the first year warranty period shall be added to the systems, when they become available, at no additional cost. In addition to first year standard warranty, software provided by Control System Contractor shall come with a 5 Year Software Maintenance license. All SNC and BAS Servers are included in this coverage. Labor to implement upgrades in years two through five are not included in standard warranty.

D. Maintenance of Control Hardware: The Control System Contractor shall inspect, repair, replace, adjust, and calibrate, as required, the controllers, control devices and associated peripheral units during the warranty period. The Control System Contractor shall then furnish a report describing the status of the equipment, problem areas (if any) noticed during service work, and description of the corrective actions taken. The report shall clearly certify that all hardware is functioning correctly.

E. Service Period: Calls for service by the Owner shall be honored within 24 hours and are not to be considered as part of routine maintenance.

F. Service Documentation: A copy of the service report associated with each owner-initiated service call shall be provided to the owner.

3.8 WARRANTY ACCESS

A. The Owner shall grant to the Control System Contractor reasonable access to the BMS during the warranty period. Remote access to the BMS (for the purpose of diagnostics and troubleshooting, via the Internet, during the warranty period) will be allowed.

3.9 OPERATION & MAINTENANCE MANUALS

A. See Division 1 for requirements. O&M manuals shall include the following elements, as a minimum:
   1. As-built control drawings for all equipment.
   2. As-built Network Communications Diagram.
   3. General description and specifications for all components.
   4. Completed Performance Verification sheets.
   5. Completed Controller Checkout/Calibration Sheets.

3.10 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 23 2113 - HYDRONIC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Hydronic system requirements.

B. Heating water piping, above grade.

C. Chilled water piping, above grade.

D. Condenser water piping, above grade.

E. Pipe hangers and supports.

F. Unions, flanges, mechanical couplings, and dielectric connections.

G. Valves:
   1. Ball valves.
   2. Butterfly valves.
   3. Check valves.
   4. Pressure independent temperature control valves and balancing valves.

H. Flow controls.

1.2 REFERENCE STANDARDS

A. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2018.

B. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2018.

C. ASME B31.9 - Building Services Piping; 2017.

D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2018.

E. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2018a.

F. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).

G. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2016.

H. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2018.

I. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2011 (Amended 2012).

J. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015, with Errata (2016).

K. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018.

1.3 SUBMITTALS

A. Product Data:
   1. Include data on pipe materials, pipe fittings, valves, and accessories.
   2. Provide manufacturers catalog information.
   3. Indicate valve data and ratings.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.1 HYDRONIC SYSTEM REQUIREMENTS

A. Comply with ASME B31.9 and applicable federal, state, and local regulations.

B. Piping: Provide piping, fittings, hangers, and supports as required, as indicated, and as follows:
   1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.
   2. Use non-conducting dielectric connections whenever jointing dissimilar metals.

3. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.

C. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges or unions to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.

D. Valves: Provide valves where indicated:
1. Provide drain valves where indicated, and if not indicated, provide at least at main shut-off, low points of piping, bases of vertical risers, and at equipment. Use 3/4 inch (20 mm) gate valves with cap; pipe to nearest floor drain.

2.2 HEATING WATER PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Schedule 40, black, using one of the following joint types:
1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D1.1/D1.1M welded.

B. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), drawn, using one of the following joint types:
1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings.
a. Solder: ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
b. Braze: AWS A5.8M/A5.8 BCuP copper/silver alloy.
2. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.
3. Mechanical Press Sealed Fittings: Double pressed type complying with ASME B16.22, utilizing EPDM, nontoxic synthetic rubber sealing elements.
a. Manufacturers:
1 Apollo Valves: www.apollovalves.com/#sle.
2 Grinnell Products: www.grinnell.com/#sle.
3 Viega LLC: www.viega.us/#sle.

2.3 CHILLED WATER PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Schedule 40, black; using one of the following joint types:
1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D1.1/D1.1M welded.

B. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), hard drawn; using one of the following joint types:
1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22, solder wrought copper fittings.
a. Solder: ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
2. Mechanical Press Sealed Fittings: Double pressed type complying with ASME B16.22, utilizing EPDM, nontoxic synthetic rubber sealing elements.
a. Manufacturers:
1 Apollo Valves: www.apollovalves.com/#sle.
2 Grinnell Products: www.grinnell.com/#sle.
3 Viega LLC: www.viega.us/#sle.

2.4 CONDENSER WATER PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Schedule 40, black.
1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings with finish matching piping; AWS D1.1/D1.1M welded.

2.5 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inches (13 to 38 mm): Malleable iron, adjustable swivel, split ring.
3. Hangers for Cold Pipe Sizes 2 Inches (50 mm) and Greater: Carbon steel, adjustable, clevis.
4. Hangers for Hot Pipe Sizes 2 to 4 Inches (50 to 100 mm): Carbon steel, adjustable, clevis.
5. Hangers for Hot Pipe Sizes 6 Inches (150 mm) and Greater: Adjustable steel yoke, cast iron roll, double hanger.
6. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches (150 mm) and Greater: Steel channels with welded spacers and hanger rods, cast iron roll.
8. Wall Support for Pipe Sizes to 3 Inches (76 mm): Cast iron hook.
9. Wall Support for Pipe Sizes 4 Inches (100 mm) and Greater: Welded steel bracket and wrought steel clamp.
10. Wall Support for Hot Pipe Sizes 6 Inches (150 mm) and Greater: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
11. Vertical Support: Steel riser clamp.

12. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
13. Floor Support for Hot Pipe Sizes to 4 Inches (100 mm): Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
14. Floor Support for Hot Pipe Sizes 6 Inches (150 mm) and Greater: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.

2.6 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS

A. Unions for Pipe 2 Inches (50 mm) and Less:
   1. Copper Pipe: Bronze, soldered joints.

B. Flanges for Pipe 2 Inches (50 mm) and Greater:
   1. Ferrous Piping: 150 psig (1034 kPa) forged steel, slip-on.
   2. Copper Piping: Bronze.
   3. Gaskets: 1/16 inch (1.6 mm) thick, preformed neoprene.

C. Dielectric Connections:
   1. Waterways:
      a. Water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint.
      b. Dry insulation barrier able to withstand 600-volt breakdown test.
      c. Construct of galvanized steel with threaded end connections to match connecting piping.
      d. Suitable for the required operating pressures and temperatures.

2.7 BALL VALVES

A. Manufacturers:
   1. Apollo Valves: www.apollovalves.com/#sle.
   2. Grinnell Products: www.grinnell.com/#sle.
   3. Viega LLC: www.viega.us/#sle.

B. Up To and Including [2.5] inches:
   1. Bronze two piece body, chrome plated brass ball, teflon seats and stuffing box ring, lever handle with balancing stops, solder or threaded ends with union.

2.8 BUTTERFLY VALVES

A. Manufacturers:
   1. Apollo Valves: www.apollovalves.com/#sle.
   2. Grinnell Products: www.grinnell.com/#sle.

B. Body: Cast or ductile iron with resilient replaceable EPDM seat, wafer or lug ends, extended neck.

C. Disc: Construct of aluminum bronze, chrome plated ductile iron, stainless steel, ductile iron with EPDM encapsulation, or Buna-N encapsulation.

D. Operator: 10 position lever handle.

2.9 SWING CHECK VALVES

A. Manufacturers:
   1. Apollo Valves: www.apollovalves.com/#sle.
   2. Grinnell Products: www.grinnell.com/#sle.

B. Up To and Including 2 Inches (50 mm):
   1. Bronze body, bronze trim, bronze rotating swing disc, with composition disc, solder ends.

C. Over 2 Inches (50 mm):
   1. Iron body, bronze trim, stainless steel swing disc, renewable disc and seat, flanged or grooved ends.

2.10 FLOW CONTROLS

A. Manufacturers:
   1. Griswold Controls: www.griswoldcontrols.com/#sle.
   2. ITT Bell & Gossett: www.bellgossett.com/#sle.
   3. Taco, Inc: www.taco-hvac.com/#sle.

B. Construction: Class 150, Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet, blowdown/backflush drain.

C. Calibration: Control flow within 10 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, minimum pressure 2 psi (13.7 kPa).

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment using jointing system specified.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

E. After completion, fill, clean, and treat systems. Refer to Section 23 2500 for additional requirements.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Route piping in orderly manner, parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and to avoid interference with use of space.

D. Group piping whenever practical at common elevations.

E. Sleeve pipe passing through partitions, walls, and floors.

F. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified.

G. Slope piping and arrange to drain at low points.

3.3 SCHEDULES

A. Hanger Spacing for Copper Tubing.
   1. 1/2 Inch (15 mm) and 3/4 inch (20 mm): Maximum span, 5 feet (1500 mm); minimum rod size, 1/4 inch (6 mm).
   2. 1 Inch (25 mm): Maximum span, 6 feet (1800 mm); minimum rod size, 1/4 inch (6 mm).
   3. 1-1/2 Inches (40 mm) and 2 Inches (50 mm): Maximum span, 8 feet (2400 mm); minimum rod size, 3/8 inch (9 mm).
   4. 2-1/2 Inches (65 mm): Maximum span, 9 feet (2700 mm); minimum rod size, 3/8 inch (9 mm).
   5. 3 Inches (80 mm): Maximum span, 10 feet (3.0 m); minimum rod size, 3/8 inch (9 mm).

B. Hanger Spacing for Steel Piping.
   1. 1/2 Inch (15 mm), 3/4 Inch (20 mm), and 1 Inch (25 mm): Maximum span, 7 feet (2100 mm); minimum rod size, 1/4 inch (6 mm).
   2. 1-1/4 Inches (32 mm): Maximum span, 8 feet (2400 mm); minimum rod size, 3/8 inch (9 mm).
   3. 1-1/2 Inches (40 mm): Maximum span, 9 feet (2700 mm); minimum rod size, 3/8 inch (9 mm).
   4. 2 Inches (50 mm): Maximum span, 10 feet (3.0 m); minimum rod size, 3/8 inch (9 mm).
   5. 2-1/2 Inches (65 mm): Maximum span, 11 feet (3.4 m); minimum rod size, 3/8 inch (9 mm).

END OF SECTION

SECTION 23 2114 - HYDRONIC SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Expansion tanks.
B. Air vents.
C. Air separators.
D. Strainers.
E. Suction diffusers.
F. Pump connectors.
G. Combination pump discharge valves.
H. Balancing valves.
I. Relief valves.
J. Pressure reducing valves.
K. Glycol system.

1.2 REFERENCE STANDARDS

A. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2015.
B. ASME B16.5 - Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard; 2017.
C. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels; 2019.

1.3 SUBMITTALS

A. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description and model.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
B. Provide temporary protective coating on cast iron and steel valves.
C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.1 EXPANSION TANKS

A. Manufacturers:
   1. Amtrol Inc: www.amtrol.com/#sle.
   2. Grundfos.
B. Construction: Welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; supplied with National Board Form U-1, rated for working pressure of 125 psi (860 kPa), with flexible EPDM diaphragm or bladder sealed into tank, and steel support stand.
C. Accessories: Pressure gauge and air-charging fitting, tank drain; precharge to 12 psi (80 kPa).
D. Automatic Cold Water Fill Assembly: Pressure reducing valve, reduced pressure double check backflow preventer, test cocks, strainer, vacuum breaker, and valved by-pass.

2.2 AIR VENTS

A. Manufacturers:
   1. Grubdfos.
B. Manual Type: Short vertical sections of 2-inch (50 mm) diameter pipe to form air chamber, with 1/8 inch (3 mm) brass needle valve at top of chamber.
C. Float Type:

1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.

2.3 AIR SEPARATORS

A. Coalescing Air/Dirt Separators:
   1. Manufacturers:
      a. Spirotherm, Inc: www.spirotherm.com/#sle.
      b. Grubdfos.
   2. Tank: Fabricated steel tank; tested and stamped in accordance with ASME BPVC-VIII-1; for 150 psi (1034 kPa) operating pressure and 270 degrees F (132 degrees C) maximum operating temperature; subject to the requirements of the application and the manufacturer's standard maximum operating conditions.
   3. Coalescing Medium: Provide stainless steel medium filling the entire vessel to suppress turbulence and provide air elimination efficiency of 100 percent free air, 100 percent entrained air, and 99.6 percent dissolved air at the installed location.
   4. Air Vent: Integral float actuated air vent at top fitting of tank rated at 150 psi (1030 kPa), threaded to the top of the separator.
   5. Inlet and Outlet Connections: Threaded for 2 NPS (50 DN) and smaller; Class 150 flanged connections for 2-1/2 NPS (65 DN) and larger.
   6. Blowdown Connection: Threaded.
   7. Size: Match system flow capacity.

2.4 STRAINERS

A. Manufacturers:
   1. Armstrong International, Inc: www.armstronginternational.com/#sle.
   2. Flexicraft Industries: www.flexicraft.com/#sle.
   3. Grinnell Products: www.grinnell.com/#sle.
   4. The Metraflex Company; LPD Y Strainer: www.metraflex.com/#sle.

B. Size 2 inch (50 mm) and Under:
   1. Screwed brass or iron body for 175 psi (1200 kPa) working pressure, Y pattern with 1/32 inch (0.8 mm) stainless steel perforated screen.

C. Size 2-1/2 inch (65 mm) to 4 inch (100 mm):
   1. Provide flanged iron body for 175 psi (1200 kPa) working pressure, Y pattern with 1/16 inch (1.6 mm) stainless steel perforated screen.

D. Size 5 inch (125 mm) and Larger:
   1. Provide flanged iron body for 175 psi (1200 kPa) working pressure, basket pattern with 1/8 inch (3.2 mm) stainless steel perforated screen.

2.5 SUCTION DIFFUSERS

A. Manufacturers:
   1. Grubdfos.

B. Fitting: Angle pattern, cast-iron body, threaded for 2 inch (50 mm) and smaller, flanged for 2-1/2 inch (65 mm) and larger, rated for 175 psi (1200 kPa) working pressure, with inlet vanes, cylinder strainer with 3/16 inch (5 mm) diameter openings, disposable 5/32 inch (4 mm) mesh strainer to fit over cylinder strainer, 20 mesh startup screen, and permanent magnet located in flow stream and removable for cleaning.

2.6 PUMP CONNECTORS

A. Manufacturers:
   1. The Metraflex Company; Vane Flex: www.metraflex.com/#sle.
   2. Grubdfos.

B. Flexible Connectors: Flanged, braided type with wetted components of stainless steel, sized to match piping.
   1. Maximum Allowable Working Pressure: 150 psig (1030 kPa) at 120 degrees F (49 degrees C).
   2. Accommodate the Following:
      a. Axial Deflection in Compression and Expansion:
      b. Lateral Movement: []
      c. Angular Rotation: 15 degrees.
      d. Force developed by 1.5 times specified maximum allowable operating pressure.
   3. End Connections: Flanged ductile iron; complying with ASME B16.1 Class 125.
   4. Provide pump connector with integral vanes to reduce turbulent flow.
   5. Provide necessary accessories including, but not limited to, swivel joints.

2.7 COMBINATION PUMP DISCHARGE VALVES

A. Manufacturers:
   1. Grundfos.

B. Valves: Straight or angle pattern, flanged cast-iron valve body with bolt-on bonnet for 175 psi (1200 kPa) operating pressure, non-slam check valve with spring-loaded bronze disc and seat, stainless steel stem, and calibrated adjustment permitting flow regulation.

2.8 BALANCING VALVES

A. Manufacturers:
   1. Armstrong International, Inc: www.armstronginternational.com/#sle.
   2. ITT Bell & Gossett: www.bellgossett.com/#sle.
   3. Taco, Inc: www.taco-hvac.com/#sle.

B. Size 2 inch (50 mm) and Smaller:
   1. Provide globe style with flow balancing, flow measurement, and shut-off capabilities, memory stops, minimum of two metering ports and NPT threaded or soldered connections.
   2. Metal construction materials consist of bronze or brass.
   3. Non-metal construction materials consist of Teflon or EPDM.

C. Size 2.5 inch (64 mm) and Larger:
   1. Provide globe style with flow balancing, flow measurement, and shut-off capabilities, memory stops, minimum of two metering ports and flanged connections.
   2. Valve body construction materials consist of cast iron, carbon steel, or ductile iron.
   3. Internal components construction materials consist of brass, aluminum bronze, bronze, Teflon, EPDM, or NORYL.

2.9 RELIEF VALVES

A. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

2.10 PRESSURE REDUCING VALVES

A. Operation: Automatically feeds make-up water to the hydronic system whenever pressure in the system drops below the pressure setting of the valve. Refer to Section 23 2113.

B. Materials of Construction:
   1. Valve Body: Constructed of bronze, cast iron, or brass.
   2. Internal Components: Construct of stainless steel or brass and engineered plastics.

C. Connections:
   1. NPT threaded: 0.50 inch (15 mm), or 0.75 inch (20 mm).
   2. Soldered: 0.50 inch (15 mm).

D. Provide integral check valve and strainer.

E. Maximum Inlet Pressure: 100 psi (689 kPa).

F. Maximum Fluid Temperature: 180 degrees F (82 degrees C).

G. Operating Pressure Range: Between 10 psi (69 kPa) and 25 psi (172 kPa).

2.11 GLYCOL SYSTEM

A. Mixing Tank: 30 gallon (XXX L)steel drum with fittings suitable for filling and hand pump for charging, rubber hose for connection of hand pump to system.

B. Storage Tank: Closed type, welded-steel construction, tested and stamped in accordance with ASME BPVC-VIII-1; 100 psi (690 kPa) rating; cleaned, prime coated, and supplied with steel support saddles. Construct with tappings for installation of accessories.

C. Expansion Tank: Diaphragm type with vent fitting with air separator, and automatic air vent.

D. Air Pressure Reducing Station: Pressure reducing valve with shut-off valves, strainer, check valve, and needle valve bypass.

E. Glycol Solution:
   1. Inhibited ethylene glycol and water solution mixed 30 percent glycol - 70 percent water, suitable for operating temperatures from 0 degrees F (XXX degrees C) to 250 degrees F (121 degrees C).

PART 3 EXECUTION

3.1 INSTALLATION

A. Install specialties in accordance with manufacturer's instructions.

B. Where large air quantities can accumulate, provide enlarged air collection standpipes.

C. Provide manual air vents at system high points and as indicated.

D. For automatic air vents provide vent tubing to nearest drain.

E. Provide air separator on suction side of system circulation pump and connect to expansion tank.

F. Provide valved drain and hose connection on strainer blowdown connection.

G. Provide pump suction fitting on suction side of base-mounted centrifugal pumps where indicated. Remove temporary strainers after cleaning systems.

H. Provide combination pump discharge valve on discharge side of base mounted centrifugal pumps where indicated.

I. Support pump fittings with floor-mounted pipe and flange supports.

J. Provide relief valves on pressure tanks, low-pressure side of reducing valves, heat exchangers, and expansion tanks.

K. Pipe relief valve outlet to nearest floor drain.

L. Where one line vents several relief valves, make cross-sectional area equal to sum of individual vent areas.

3.2 MAINTENANCE

A. Provide service and maintenance of glycol system for one year from date of Substantial Completion at no extra charge to Owner.

B. Perform monthly visit to make glycol fluid concentration analysis on site with refractive index measurement instrument. Report findings in detail in writing, including analysis and amounts of glycol or water added.

C. Explain corrective actions to Owner's maintenance personnel in person.

END OF SECTION

SECTION 23 2123 - HYDRONIC PUMPS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Base-mounted pumps.

1.2 SUBMITTALS

A. Product Data: Provide certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

B. Millwright's Certificate: Certify that base mounted pumps have been aligned.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Grundfos.

2.2 HVAC PUMPS - GENERAL

A. Provide pumps that operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

B. Base Mounted Pumps: Aligned by qualified millwright.

C. Products Requiring Electrical Connection: Listed and classified by UL or testing agency acceptable to Authority Having Jurisdiction as suitable for the purpose specified and indicated.

2.3 BASE-MOUNTED PUMPS

A. Type: Horizontal shaft, single stage, direct connected, radially or horizontally split casing, for 125 psi (860 kPa) maximum working pressure.

B. Casing: Cast iron, or ductile iron with suction and discharge gauge ports, renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction and discharge.

C. Impeller: Bronze, fully enclosed, keyed to shaft.

D. Bearings: Oil lubricated roller or ball bearings.

E. Shaft: Alloy steel with copper, bronze, or stainless steel shaft sleeve.

F. Seal: Mechanical seal, 225 degrees F (107 degrees C) maximum continuous operating temperature.

G. Drive: Flexible coupling with coupling guard.

H. Baseplate: Cast iron or fabricated steel with integral drain rim.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide access space around pumps for service. Provide no less than minimum space recommended by manufacturer.

C. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. For close-coupled or base-mounted pumps, provide supports under elbows on pump suction and discharge line sizes 4 inches (102 mm) and over.

D. Provide line sized shut-off valve and strainer on pump suction, and line sized soft seat check valve and balancing valve on pump discharge.

E. Provide air cock and drain connection on horizontal pump casings.

F. Provide drains for bases and seals, piped to and discharging into floor drains.

G. Check, align, and certify alignment of base-mounted pumps prior to start-up.

H. Install close-coupled and base-mounted pumps on concrete housekeeping base, with anchor bolts, set and level, and grout in place. Refer to Section 03 3000.

I. Lubricate pumps before start-up.

END OF SECTION

SECTION 23 2213 - STEAM AND CONDENSATE HEATING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe and pipe fittings.

B. Pipe hangers and supports.

C. Steam piping system.

D. Steam condensate piping system.

1.2 RELATED REQUIREMENTS

A. Section 23 2500 - HVAC Water Treatment: Pipe cleaning.

1.3 REFERENCE STANDARDS

A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2016.

B. ASME B31.9 - Building Services Piping; 2017.

C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2018.

D. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2018a.

E. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015, with Errata (2016).

F. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018.

1.4 SYSTEM DESCRIPTION

A. When more than one piping system material is selected, ensure systems components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, unions, and couplings for servicing are consistently provided.

B. Use unions and flanges downstream of valves and at equipment or apparatus connections. Use dielectric unions where joining dissimilar materials. Do not use direct welded or threaded connections.

C. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.

1.5 SUBMITTALS

A. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories. Provide manufacturers catalogue information. Indicate valve data and ratings.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labelling in place. Inspect for damage.

B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.1 MEDIUM AND HIGH PRESSURE STEAM PIPING (150 PSIG (1034 KPA) MAXIMUM)

A. Steel Pipe: ASTM A53/A53M, Schedule 80, black.
   1. Fittings: ASME B16.3 malleable iron Class 150, or ASTM A234/A234M wrought steel welding type.
   2. Joints: Threaded, or AWS D1.1/D1.1M welded.

2.2 LOW PRESSURE STEAM PIPING (15 PSIG (103 KPA) MAXIMUM)

A. Steel Pipe: ASTM A53/A53M, Schedule 40, black.
   1. Fittings: ASME B16.3 malleable iron Class 150, or ASTM A234/A234M wrought steel.
   2. Joints: Threaded, or AWS D1.1/D1.1M welded.

2.3 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
   1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.

B. Hangers for Pipe Sizes 2 to 4 Inches (50 to 100 mm): Carbon steel, adjustable, clevis.

C. Multiple or Trapeze Hangers for Pipe Sizes to 4 inches (100 mm): Steel channels with welded spacers and hanger rods.

D. Multiple or Trapeze Hangers for Pipe Sizes 6 Inches (150 mm) and Over: Steel channels with welded spacers and hanger rods; cast iron roll and stand.

E. Wall Support for Pipe Sizes to 3 Inches (70 mm): Cast iron hook.

F. Wall Support for Pipe Sizes 4 to 5 Inches (100 to 125 mm): Welded steel bracket and wrought steel clamp.

G. Wall Support for Pipe Sizes 6 Inches (150 mm) and Over: Welded steel bracket and wrought steel clamp; adjustable steel yoke and cast iron roll.

H. Vertical Support: Steel riser clamp.

I. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

J. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.4 UNIONS, FLANGES, AND COUPLINGS

A. Unions for Pipe 2 Inches (50 mm) and Under:
   1. Ferrous Piping: 150 psig (1034 kPa) galvanized malleable iron, threaded.

B. Flanges for Pipe Over 2 Inches (50 mm):
   1. Ferrous Piping: 150 psig (1034 kPa) forged steel, slip-on.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Whenever work is suspended during construction protect open ends with temporary plugs or caps.

E. After completion, fill, clean, and treat systems. Refer to Section 23 2500.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Route piping in orderly manner, plumb and parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and avoid interference with use of space.

D. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

E. Inserts:
   1. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

F. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9.

G. Provide clearance for installation of insulation and access to valves and fittings.

H. Slope steam condensate piping one inch in 40 feet (0.25 percent). Provide drip trap assembly at low points and before control valves. Run condensate lines from trap to nearest condensate receiver. Provide loop vents over trapped sections.

3.3 SCHEDULES

A. Hanger Spacing for Steel Steam Piping.
   1. 1/2 inch (15 mm): Maximum span, 8 feet (2400 mm); minimum rod size, 1/4 inch (6 mm).
   2. 3/4 inch (20 mm) and 1 inch (25 mm): Maximum span, 9 feet (2700 mm); minimum rod size, 1/4 inch (6 mm).
   3. 1-1/4 inches (32 mm): Maximum span, 11 feet (3.3 m); minimum rod size, 3/8 inch (9 mm).
   4. 1-1/2 inches (40 mm): Maximum span, 12 feet (3.6 m); minimum rod size, 3/8 inch (9 mm).
   5. 2 inches (50 mm): Maximum span, 13 feet (4.0 m); minimum rod size, 3/8 inch (9 mm).
   6. 2-1/2 inches (65 mm): Maximum span, 14 feet (4.2 m); minimum rod size, 3/8 inch (9 mm).
   7. 3 inches (80 mm): Maximum span, 15 feet (4.5 m); minimum rod size, 3/8 inch (9 mm).

B. Hanger Spacing for Steel Steam Condensate Piping.
   1. 1/2 inch (15 mm), 3/4 inch (20 mm), and 1 inch (25 mm): Maximum span, 7 feet (2100 mm); minimum rod size, 1/4 inch (6 mm).
   2. 1-1/4 inches (32 mm): Maximum span, 8 feet (2400 mm); minimum rod size, 3/8 inch (9 mm).
   3. 1-1/2 inches (40 mm): Maximum span, 9 feet (2700 mm); minimum rod size, 3/8 inch (9 mm).
   4. 2 inches (50 mm): Maximum span, 10 feet (3.0 m); minimum rod size, 3/8 inch (9 mm).
   5. 2-1/2 inches (65 mm): Maximum span, 11 feet (3.4 m); minimum rod size, 3/8 inch (9 mm).
   6. 3 inches (80 mm): Maximum span, 12 feet (3.6 m); minimum rod size, 3/8 inch (9 mm).

END OF SECTION

SECTION 23 3100 - HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal ductwork.

B. Casing and plenums.

C. Duct cleaning.

1.2 REFERENCE STANDARDS

A. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals; Most Recent Edition Cited by Referring Code or Reference Standard.

B. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2017.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2019a.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.

E. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2015.

F. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements; 2015.

G. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2015.

H. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements; 2016.

I. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2018.

J. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Revised 2009).

K. SMACNA (KVS) - Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines; 2001.

L. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; 2012.

M. UL 1978 - Grease Ducts; Current Edition, Including All Revisions.

1.3 SUBMITTALS

A. Product Data: Provide data for duct materials, duct liner, and duct connections.

B. **Shop Drawings: Indicate duct fittings, particulars such as gages, sizes, welds, and configuration prior to start of work for** 3"wg pressure class and higher systems.

1.4 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.1 DUCT ASSEMBLIES

A. Regulatory Requirements: Construct ductwork to comply with NFPA 90A standards.

B. Ducts: Galvanized steel, unless otherwise indicated.

C. Low Pressure Supply (Heating Systems): 2 inch w.g. (500 Pa) pressure class, galvanized steel.

D. Low Pressure Supply (System with Cooling Coils): 2 inch w.g. (500 Pa) pressure class, galvanized steel.

E. Return and Relief: 3 inch w.g. (___ Pa) pressure class, galvanized steel.

F. General Exhaust: 3 inch w.g. (___ Pa) pressure class, galvanized steel.

2.2 MATERIALS

A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G90/Z275 coating.

B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
   1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
   2. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.

C. Gasket Tape: Provide butyl rubber gasket tape for a flexible seal between transfer duct connector (TDC), transverse duct flange (TDF), applied flange connections, and angle rings connections.

D. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
   1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
   2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
   3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
   4. Masonry Screw Type Anchors: Complying with ICC-ES AC106.
   5. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.
   6. Other Types: As required.

2.3 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA (DCS) and as indicated.

B. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

C. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.

D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

E. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).

F. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

2.4 MANUFACTURED DUCTWORK AND FITTINGS

A. Spiral Ducts: Round spiral lockseam duct with galvanized steel outer wall.
   1. Manufacture in accordance with SMACNA (DCS).

B. Flexible Ducts: Black polymer film supported by helically wound spring steel wire.
   1. UL labeled.
   2. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
   3. Pressure Rating: 4 inches WG (1000 Pa) positive and 0.5 inches WG (175 Pa) negative.
   4. Maximum Velocity: 4000 fpm (20.3 m/sec).
   5. Temperature Range: Minus 20 degrees F to 175 degrees F (Minus 28 degrees C to 79 degrees C).

C. Transverse Duct Connection System: SMACNA "E" rated rigidly class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips in accordance with SMACNA (DCS).

D. Round Duct Connection System: Interlocking duct connection system in accordance with SMACNA (DCS).

2.5 CASINGS

A. Fabricate casings in accordance with SMACNA (DCS) and construct for operating pressures indicated.

B. Mount floor mounted casings on 4 inch (100 mm) high concrete curbs. At floor, rivet panels on 8 inch (200 mm) centers to angles. Where floors are acoustically insulated, provide liner of galvanized 18 gage, 0.0478 inch (1.21 mm) expanded metal mesh supported at 12 inch (300 mm) centers, turned up 12 inches (300 mm) at sides with sheet metal shields.

C. Reinforce door frames with steel angles tied to horizontal and vertical plenum supporting angles. Install hinged access doors where indicated or required for access to equipment for cleaning and inspection.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. Install in accordance with manufacturer's instructions.

C. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

D. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.

E. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

F. Use crimp joints with or without bead for joining round duct sizes 8 inch (200 mm) and smaller with crimp in direction of air flow.

G. Use double nuts and lock washers on threaded rod supports.

H. Connect terminal units to supply ducts with one foot (300 mm) maximum length of flexible duct. Do not use flexible duct to change direction.

I. Connect diffusers or light troffer boots to low pressure ducts with 5 feet (1.5 m) maximum length of flexible duct held in place with strap or clamp.

J. At exterior wall louvers, seal duct to louver frame.

3.2 CLEANING

A. Clean duct systems with high power vacuum machines. Protect equipment that could be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.

END OF SECTION

SECTION 23 3300 - AIR DUCT ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Air turning devices/extractors.
B. Backdraft dampers - metal.
C. Duct access doors.
D. Duct test holes.
E. Flexible duct connectors.
F. Volume control dampers.
G. Low leakage (Class 1A) control dampers.

1.2 RELATED REQUIREMENTS

A. Section 23 3100 - HVAC Ducts and Casings.

1.3 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.
B. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2018.
C. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Revised 2009).
D. UL 555 - Standard for Fire Dampers; Current Edition, Including All Revisions.
E. UL 1978 - Grease Ducts; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.
B. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers.

PART 2 PRODUCTS

2.1 AIR TURNING DEVICES/EXTRACTORS

A. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.

2.2 BACKDRAFT DAMPERS - METAL

A. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Galvanized steel, with center pivoted blades of maximum 6 inch (150 mm) width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.3 DUCT ACCESS DOORS

A. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ducts, install minimum 1 inch (25 mm) thick insulation with sheet metal cover.
   1. Less Than 12 inches (300 mm) Square: Secure with sash locks.
   2. Up to 18 inches (450 mm) Square: Provide two hinges and two sash locks.
   3. Up to 24 by 48 inches (600 by 1200 mm): Three hinges and two compression latches with outside and inside handles.
   4. Larger Sizes: Provide an additional hinge.

2.4 DUCT TEST HOLES

A. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.5 FLEXIBLE DUCT CONNECTORS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.
B. Flexible Duct Connections: Fabric crimped into metal edging strip.
   1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd (1.0 kg/sq m).

2. Metal: 3 inches (75 mm) wide, 24 gage, 0.0239 inch (0.61 mm) thick galvanized steel.

C. Maximum Installed Length: 14 inch (356 mm).

2.6 VOLUME CONTROL DAMPERS

A. Manufacturers:

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Splitter Dampers:
1. Material: Same gage as duct to 24 inches (600 mm) size in either direction, and two gages heavier for sizes over 24 inches (600 mm).
2. Blade: Fabricate of single thickness sheet metal to streamline shape, secured with continuous hinge or rod.
3. Operator: Minimum 1/4 inch (6 mm) diameter rod in self aligning, universal joint action, flanged bushing with set screw .

D. Single Blade Dampers:
1. Fabricate for duct sizes up to 6 by 30 inch (150 by 760 mm).
2. Blade: 24 gage, 0.0239 inch (0.61 mm), minimum.

E. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 by 72 inch (200 by 1825 mm). Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.

F. End Bearings: Except in round ducts 12 inches (300 mm) and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.

G. Quadrants:
1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
3. Where rod lengths exceed 30 inches (750 mm) provide regulator at both ends.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.2 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 23 3100 for duct construction and pressure class.

B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide for cleaning kitchen exhaust ducts in accordance with NFPA 96. Provide minimum 8 by 8 inch (200 by 200 mm) size for hand access, size for shoulder access, and as indicated. Provide 4 by 4 inch (100 by 100 mm) for balancing dampers only. Review locations prior to fabrication.

D. Provide duct test holes where indicated and required for testing and balancing purposes.

E. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

F. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.

G. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

H. Use splitter dampers only where indicated.

I. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION

SECTION 23 3423 - HVAC POWER VENTILATORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Roof exhausters.

B. Roof ventilators.

C. Ceiling exhaust fans.

D. Inline centrifugal fans.

1.2 RELATED REQUIREMENTS

A. Section 23 3300 - Air Duct Accessories: Backdraft dampers.

1.3 REFERENCE STANDARDS

A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program; 2015.

B. AMCA 99 - Standards Handbook; 2016.

C. AMCA 204 - Balance Quality and Vibration Levels for Fans; 2005 (Reaffirmed 2012).

D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2016.

E. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; 2014.

F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2014.

1.4 SUBMITTALS

A. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.

1.5 FIELD CONDITIONS

A. Permanent ventilators may not be used for ventilation during construction.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Greenheck Fan Corporation: www.greenheck.com/#sle.

B. Loren Cook Company: www.lorencook.com/#sle.

C. PennBarry, Division of Air System Components: www.pennbarry.com/#sle.

2.2 POWER VENTILATORS - GENERAL

A. Static and Dynamically Balanced: AMCA 204 - Balance Quality and Vibration Levels for Fans.

B. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.

C. Sound Ratings: AMCA 301, tested to AMCA 300 and bearing AMCA Certified Sound Rating Seal.

D. Fabrication: Comply with AMCA 99.

E. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.3 ROOF VENTILATORS

A. Fan Unit: V-belt or direct driven as indicated, with spun aluminum housing; resilient mounted motor; 1/2 inch (13 mm) mesh, 0.62 inch (1.6 mm) thick aluminum wire birdscreen; square base to suit roof curb with continuous curb gaskets.

B. Roof Curb: 16 inch (400 mm) high self-flashing of galvanized steel with continuously welded seams, built-in cant strips.

C. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor and wall mounted multiple speed switch.

D. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked, and line voltage motor drive, power open, spring return.

E. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

2.4 INLINE CENTRIFUGAL FANS

A. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.

B. Disconnect Switch: Cord and plug in housing for thermal overload protected motor and wall mounted switch.

C. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure roof exhausters with cadmium plated steel lag screws to roof curb.

C. Extend ducts to roof exhausters into roof curb. Counterflash duct to roof opening.

D. Hung Cabinet Fans:
   1. Install flexible connections specified in Section 23 3300 between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one inch (25 mm) flex between ductwork and fan while running.

E. Provide Vibtation Isolation Hangers.

F. Provide sheaves required for final air balance.

G. Install backdraft dampers on inlet to roof and wall exhausters.

END OF SECTION

SECTION 23 3600 - AIR TERMINAL UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Single-duct terminal units.
   1. Single-duct, constant-volume units.

1.2 RELATED REQUIREMENTS

A. Section 23 0548 - Vibration and Seismic Controls for HVAC.

B. Section 23 3100 - HVAC Ducts and Casings.

1.3 REFERENCE STANDARDS

A. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils; 2001, with Addendum (2011).

B. AHRI 880 (I-P) - Performance Rating of Air Terminals; 2017.

C. ASHRAE Std 62.1 - Ventilation for Acceptable Indoor Air Quality; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. ASHRAE Std 130 - Methods of Testing Air Terminal Units; 2016.

E. ASTM A492 - Standard Specification for Stainless Steel Rope Wire; 1995 (Reapproved 2013).

F. ASTM A603 - Standard Specification for Zinc-Coated Steel Structural Wire Rope; 1998 (Reapproved 2014).

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2018.

J. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; 2008.

K. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; current edition, including all revisions.

1.4 SUBMITTALS

A. Product Data: Provide data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings that indicate air flow, static pressure, and NC designation. Include electrical characteristics and connection requirements.

B. Shop Drawings: Indicate configuration, general assembly, and materials used in fabrication, and electrical characteristics and connection requirements.
   1. Include schedules listing discharge and radiated sound power level for each of second through sixth octave bands at inlet static pressures of 1 to 4 inch wg (250 to 1000 Pa).

PART 2 PRODUCTS

2.1 SINGLE-DUCT, VARIABLE-VOLUME UNITS

A. Manufacturers:
   1. Johnson Controls, Inc: www.johnsoncontrols.com/#sle.
   2. Krueger-HVAC: www.krueger-hvac.com/#sle.
   3. Price Industries, Inc: www.priceindustries.com/#sle.
   4. Titus.

B. General:
   1. Factory-assembled, AHRI 880 (I-P) rated and bearing the AHRI seal, air volume control terminal with damper assembly, flow sensor, externally mounted volume controller, duct collars, and all required features.
   2. Control box bearing identification, including but not necessarily limited to nominal cfm, maximum and minimum factory-set airflow limits, coil type and coil (right or left hand) connection, where applicable.

C. Unit Casing:
   1. Minimum 22 gage, 0.0299 inch (0.76 mm) galvanized steel.
      a. Assembled with longitudinal lock seam construction.
      b. Casing leakage to meet ASHRAE Std 130.
   2. Air Inlet Collar: Provide round, suitable for standard flexible duct sizes.
   3. Unit Discharge: Rectangular, with slip-and-drive connections.
   4. Acceptable Liners:

a. 3/4 inch (19 mm) thick polyurethane foam adhesive complying with UL 181 erosion requirements in accordance with ASHRAE Std 62.1, and having a maximum smoke developed index of 50 for both insulation and adhesive, when tested in accordance with ASTM E84.
b. Liner not to contain pentabrominated diphenyl ether (CAS #32534-81-9) or octabrominated diphenyl ether.

D. Sound Attenuator:
1. Provide if required to meet scheduled acoustical performance requirements.
2. Construction to consist of a continuous extension of the casing and liner as required to achieve required attenuation.
3. At 2000 fpm (10.16 m/s) inlet velocity, the minimum operating pressure with attenuator added not to exceed 0.14 inch wg (34.84 Pa).

E. Damper Assembly:
1. Heavy-gage, galvanized steel or extruded aluminum construction with solid steel, nickel-plated shaft pivoting on HDPE, self-lubricating bearings.
2. Provide integral position indicator or alternative method for indicating damper position over full range of 90 degrees.
3. Incorporate low leak damper blades for tight airflow shutoff.

F. Hot Water Heating Coil:
1. Coil Casing: Minimum 22 gage, 0.0299 inch (0.76 mm) galvanized steel, factory-installed on terminal discharge with rectangular outlet, duct connection type.
2. Coil Fins: Aluminum or aluminum plated fins, mechanically-bonded to seamless copper tubes.
3. Coil leak tested to minimum 350 psig (2413 kPa).
4. Base performance data on tests run in accordance with AHRI 410 and units to bear AHRI 410 label.

G. Controls:
1. DDC (Direct-Digital Controls): Refer to Section 23 0923
a. Bi-directional Damper Actuator: 24 volt, powered closed, spring return open.
b. Microprocessor-Based Controller: Air volume controller, pressure-independent with electronic airflow transducers, factory-calibrated maximum and minimum CFM's.
1 Occupied and unoccupied operating mode.
2 Remote reset of temperature or CFM set points.
3 Proportional, plus integral control of room temperature.
4 Monitoring and adjusting with portable terminal.
c. Room Sensor:
1 Compatible with temperature controls specified.
2 Wall-mounted, system powered, with temperature set-point adjustment including connection access for portable operator terminal. Room sensors shall be selected by the owner and provided by the Controls contractor.
2. Control Sequence:
a. Suitable for operation with duct pressures between 0.25 and 3.0 inch wg (60 and 750 Pa) inlet static pressure.
b. Include factory-mounted and piped, 5-micron filter; and adjustable, velocity-resetting, high-limit control with amplifying relay.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install the inlets of air terminal units and air flow sensors a minimum of four duct diameters from elbows, transitions, and duct takeoffs.

C. Provide ceiling access doors or locate units above easily removable ceiling components.

D. Support units individually from structure with wire rope complying with ASTM A492 and ASTM A603 in accordance with SMACNA (SRM). See Section 23 0548.

E. Do not support from ductwork.

F. Connect to ductwork in accordance with Section 23 3100.

3.2 ADJUSTING

A. Reset volume with damper operator attached to assembly allowing flow range modulation from 100 percent of design flow to zero percent full flow. Set units with heating coils for minimum 50 percent full flow.

3.3 CLEANING

A. Vacuum clean coils and inside of units.

END OF SECTION

SECTION 23 3700 - AIR OUTLETS AND INLETS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Diffusers:
   1. Rectangular ceiling diffusers.
   2. Slot ceiling diffusers.

B. Registers/grilles:
   1. Ceiling-mounted, exhaust and return register/grilles.
   2. Wall-mounted, supply register/grilles.
   3. Wall-mounted, exhaust and return register/grilles.

C. Duct-mounted supply and return registers/louvers.

1.2 RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting: Painting of ducts visible behind outlets and inlets.

1.3 REFERENCE STANDARDS

A. AHRI 880 (I-P) - Performance Rating of Air Terminals; 2017.

B. AMCA 511 - Certified Ratings Program for Air Control Devices; 2010.

C. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Inlets; 2006 (Reaffirmed 2011).

D. ASHRAE Std 130 - Methods of Testing Air Terminal Units; 2016.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.

F. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2018.

G. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Revised 2009).

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, air flow CFM and noise level.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Krueger-HVAC: www.krueger-hvac.com/#sle.

B. Price Industries: www.price-hvac.com/#sle.

C. Titus, a brand of Air Distribution Technologies: www.titus-hvac.com/#sle.

2.2 RECTANGULAR CEILING DIFFUSERS

A. Fabrication: Aluminum with baked enamel finish.

B. Color: As selected by Architect from manufacturer's standard range.

C. Accessories: Provide radial opposed blade volume control damper; sectorizing baffle with damper adjustable from diffuser face.

2.3 CEILING SLOT DIFFUSERS

A. Type: Continuous as indicated on drawings .

B. Fabrication: Aluminum extrusions with factory clear lacquer finish.

C. Color: To be selected by Architect from manufacturer's standard range.

D. Plenum: Integral, galvanized steel, insulated.

2.4 CEILING EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Streamlined blades, 3/4 inch (19 mm) minimum depth, [] maximum spacing, with blades set at 45 degrees, horizontal face.

B. Color: To be selected by Architect from manufacturer's standard range.

C. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face where not individually connected to exhaust fans.

2.5 WALL SUPPLY REGISTERS/GRILLES

A. Type: Streamlined and individually adjustable blades, 3/4 inch (19 mm) minimum depth, [] maximum spacing with spring or other device to set blades, horizontal face, double deflection.

B. Color: To be selected by Architect from manufacturer's standard range.

2.6 WALL EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Streamlined blades, 3/4 inch (19 mm) minimum depth, 3/4 inch (19 mm) maximum spacing, with spring or other device to set blades, vertical face.

B. Fabrication: Steel and aluminum, with factory [] finish.

C. Color: To be selected by Architect from manufacturer's standard range.

2.7 LOUVERS

A. Type: 6 inch (150 mm) deep frame with[], heavy channel frame, 1/2 inch (13 mm) square mesh screen over intake or exhaust end.

B. Fabrication: Aluminum thick galvanized steel welded assembly, with factory [] finish.

C. Color: To be selected by Architect from manufacturer's custom range.

D. Mounting: Furnish with exterior angle flange for installation.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Comply with SMACNA (ASMM) for flashing/counter-flashing of roof penetrations and supports for roof curbs and roof mounted equipment.

C. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.

D. Install diffusers to ductwork with air tight connection.

E. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.

F. Paint ductwork visible behind air outlets and inlets matte black. Refer to Section 09 9123.

END OF SECTION

SECTION 23 5700 - HEAT EXCHANGERS FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Shell and tube type heat exchangers.

B. Accessories and trim.

1.2 RELATED REQUIREMENTS

A. Section 23 2114 - Hydronic Specialties.

B. Section 23 2214 - Steam and Condensate Heating Specialties.

1.3 REFERENCE STANDARDS

A. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels; 2019.

PART 2 PRODUCTS

2.1 SHELL AND TUBE TYPE HEAT EXCHANGER

A. Manufacturers:
   1. Grundfos.

B. Comply with ASME BPVC-VIII-1 for manufacture of tubular heat exchangers and heat exchanger shells.

C. Tubes: U-tube type with 3/4 inch (20 mm) OD minimum seamless copper tubes suitable for 125 psi (860 kPa) working pressure.

D. Shell: Steel pipe with threaded or flanged piping connections and necessary tappings, steel saddle and attaching U-bolts, prime coated.

E. Heads: Cast iron or fabricated steel with steel or bronze tube sheets, threaded or flanged for piping connections.

F. Water Chamber and Tube Bundle: Removable for inspection and cleaning.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install to permit removal of tube bundle with minimum disturbance to installed equipment and piping.

C. Support heat exchangers from structure.

D. Pitch shell to completely drain condensate.

E. Pipe relief valves to nearest floor drain.

3.2 STEAM TO WATER HEAT EXCHANGER TRIM

A. Shell: Pressure gauge tapping with pigtail siphon, vacuum breaker; refer to Section 23 2214.

B. Water Inlet: Thermometer well, pressure gauge tapping, valved drain; refer to Section 23 2114.

C. Water Outlet: Thermometer well for temperature regulator sensor, ASME rated pressure and temperature relief valve, thermometer well, pressure gauge tapping; refer to Section 23 2114.

END OF SECTION

SECTION 23 7313 - MODULAR INDOOR CENTRAL-STATION AIR-HANDLING UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Casing construction.

B. Fan section.

C. Coil section.

D. Filter and air cleaner section.

E. Damper section.

F. Controls.

1.2 RELATED REQUIREMENTS

A. Section 22 0548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.

B. Section 23 3413 - Axial HVAC Fans.

1.3 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; 2015.

B. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils; 2001, with Addendum (2011).

C. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program; 2015.

D. AMCA 99 - Standards Handbook; 2016.

E. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2016.

F. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; 2014.

G. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2014.

H. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating; 2018.

I. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2017.

J. ASHRAE Std 62.1 - Ventilation for Acceptable Indoor Air Quality; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

K. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. ASTM B177/B177M - Standard Guide for Engineering Chromium Electroplating; 2011 (Reapproved 2017).

M. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2018.

N. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Revised 2009).

1.4 SUBMITTALS

A. Product Data:
   1. Published Literature: Indicate dimensions, weights, capacities, ratings, gauges and finishes of materials, and electrical characteristics and connection requirements.
   2. Filters: Data for filter media, filter performance data, filter assembly, and filter frames.
   3. Fans: Performance and fan curves with specified operating point clearly plotted, power, RPM.
   4. Sound Power Level Data: Fan outlet and casing radiation at rated capacity.
   5. Electrical Requirements: Power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.

B. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Fan Belts: One set for each unit.
   2. Extra Filters: One set for each unit.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept products on site in factory-fabricated protective containers, with factory-installed shipping skids and lifting lugs. Inspect for damage.

B. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

C. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Daikin Applied: www.daikinapplied.com/#sle.

B. Trane Inc: www.trane.com/#sle.

C. York International Corporation / Johnson Controls Inc: www.york.com/#sle.

2.2 CASING CONSTRUCTION

A. Full Perimeter Base Rail:
   1. Construct of galvanized steel.
   2. Provide base rail of sufficient height to raise unit for external trapping of condensate drain pans.

B. Casing:
   1. Construct of one piece, insulated, double wall panels.
   2. Provide mid-span, no through metal, internal thermal break.
   3. Construct outer panels of galvanized steel and inner panels of galvanized steel.
   4. Casing Air Pressure Performance Requirements:
      a. Able to withstand up to 8 inches w.g. (2 kPa) positive or negative static pressure.
      b. Not to exceed 0.0042 inches per inch (0.0042 mm/mm) deflection at 1.5 times design static pressure up to a maximum of plus 8 inches w.g. (2 kPa) in positive pressure sections and minus 8 inches w.g. (2 kPa) in negative pressure sections.

C. Access Doors:
   1. Construction, thermal and air pressure performance same as casing.
   2. Provide surface mounted handles on hinged, swing doors.

D. Outdoor Unit Roof:
   1. Factory install single layer outer roof above inner roof.
   2. Slope at a minimum of 0.125 inches per foot (10.41 mm/m) from one side of unit to the other side, or from center to sides of unit.
   3. Roof assembly to overhang each unit wall or base rail to overhang curb to facilitate water runoff and prevent water intrusion into roof curb to base connection.

E. Outside Air and Exhaust Air Weather Hood:
   1. Fabricate from same material as casing outer panel.
   2. Extend hood past perimeter of unit casing opening so as not to instruct airflow path.
   3. Paint hoods with same finish as external surface of outdoor units.
   4. Provide inlet hood for each fresh air damper with a sine wave moisture eliminator to prevent entrainment of water into the unit from outside air.
   5. Provide exhaust hoods for each exhaust air opening.
   6. Size each hood for 100 percent of nominal fresh air damper capacities.
   7. Protect each hood with bird screen to prevent nesting at intake or exhaust air flow paths.

F. Unit Flooring: Construct with sufficient strength to support expected people and equipment loads associated with maintenance activities.

G. Casing Leakage: Seal joints and provide airtight access doors so that air leakage does not exceed one percent of design flow at the specified casing pressure.

H. Insulation:
   1. Provide minimum thermal thickness of 12 R (2.29 RSI) throughout.
   2. Completely fill panel cavities in each direction to prevent voids and settling.
   3. Comply with NFPA 90A.

I. Drain Pan Construction:
   1. Provide cooling coil and humidifier sections with an insulated, double wall, galvanized steel drain pan complying with ASHRAE Std 62.1 for indoor air quality and sufficiently sized to collect all condensate.
   2. Slope in two planes to promote positive drainage and eliminate stagnate water conditions.
   3. Locate outlet of sufficient diameter at lowest point of pan to prevent overflow at normal operating conditions.

4. Provide threaded drain connections constructed of drain pan material, extended sufficient distance beyond the base to accommodate field installed, condensate drain trapping.

J. Finish:
   1. Indoor Units:
      a. Provide exterior, galvanized steel panels with painted surface complying with ASTM B177/B177M.
      b. Color: Manufacturer's standard color.

2.3 FAN SECTION

A. Type: Forward curved, single width, single inlet, centrifugal plug type fan, in compliance with AMCA 99. Refer to Section 23 3413.

B. Performance Ratings: Determined in accordance with AMCA 210 and labeled with AMCA Certified Rating Seal.

C. Sound Ratings: AMCA 301; tested to AMCA 300 and label with AMCA Certified Sound Rating Seal.

D. Bearings: Self-aligning, grease lubricated, with lubrication fittings extended to exterior of casing with plastic tube and grease fitting rigidly attached to casing.

E. Mounting:
   1. Locate fan and motor internally on welded steel base coated with corrosion resistant paint.
   2. Factory mount motor on slide rails.
   3. Provide access to motor, drive, and bearings through removable casing panels or hinged access doors.
   4. Mount base on vibration isolators.

F. External Motor Junction Box: Factory mount NEMA 4 external junction box and connect to extended motor leads from internally mounted motors.

G. Motor Wiring Conduit: Factory wire fan motor wiring to the unit mounted starter-disconnect, variable frequency drive, and external motor junction box.

H. Fan Accessories:

I. Flexible Duct Connections:
   1. For separating fan, coil, and adjacent sections.

J. Drives:
   1. Comply with AMCA 99.
   2. Bearings: Heavy duty pillow block type, ball bearings, with ABMA STD 9, L-10 life at 50,000 hours.
   3. Shafts: Solid, hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.
   4. V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, bored to fit shafts, and keyed. Variable and adjustable pitch sheaves for motors 15 hp and under selected so required rpm is obtained with sheaves set at mid-position; fixed sheave for 20 hp and over, matched belts, and drive rated as recommended by manufacturer or minimum 1.5 times nameplate rating of the motor.
   5. Belt Guard: Fabricate to SMACNA (DCS); 0.106 inch (2.6 mm) thick, 3/4 inch (20 mm) diamond mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation, with provision for adjustment of belt tension, lubrication, and use of tachometer with guard in place.

2.4 COIL SECTION

A. Casing: Provide access to both sides of coils. Enclose coils with headers and return bends exposed outside casing. Slide coils into casing through removable end panel with blank off sheets and sealing collars at connection penetrations.

B. Drain Pans: 24 inch (600 mm) downstream of coil and down spouts for cooling coil banks more than one coil high.

C. Eliminators: Three break of galvanized steel, mounted over drain pan.

D. Air Coils:
   1. Certify capacities, pressure drops, and selection procedures in accordance with AHRI 410.

E. Fabrication:
   1. Tubes: 5/8 inch (16 mm) OD seamless copper expanded into fins, brazed joints.
   2. Fins: Aluminum.
   3. Casing: Die formed channel frame of galvanized steel.

F. Water Heating Coils:
   1. Headers: Cast iron, seamless copper tube, or prime coated steel pipe with brazed joints.

2. Configuration: Drainable, with threaded plugs for drain and vent; serpentine type with return bends on smaller sizes and return headers on larger sizes.

G. Water Cooling Coils:
1. Headers: Cast iron, seamless copper tube, or prime coated steel pipe with brazed joints.
2. Configuration: Drainable, with threaded plugs for drain and vent; threaded plugs in return bends and in headers opposite each tube.

2.5 FILTER AND AIR CLEANER SECTION

A. General: Provide filter sections with filter racks, minimum of one access door for filter removal, and filter block-offs to prevent air bypass.

B. Hi-Efficiency Filters:
1. Media: 2 inch (50 mm) prefilter and 4 inch (305 mm) closely spaced, pleated, fine fiber, hi-efficiency filter, sealed into a rigid frame, and capable of operating up to a maximum of 625 fpm (3.17 mps) without loss of efficiency and holding capacity.
2. Filter Rack: Side-access designed to hold rigid frames.
3. Minimum Efficiency Reporting Value: 13 MERV when tested in accordance with ASHRAE Std 52.2.

C. Differential Pressure Gauge:
1. Provide factory installed dial type differential pressure gauge, flush mounted with casing outer wall, and fully piped to both sides of each filter to indicate status.
2. Maintain plus/minus 5 percent accuracy within operating limits of 20 degrees F (minus 6.7 degrees C) to 120 degrees F (48.9 degrees C).

2.6 DAMPER SECTION

A. Filter-Mixing Section: Provide a functional section to support the damper assembly for modulating the volume of outdoor and return air.

B. Damper Blades:
1. Double-skin airfoil design with metal, compressible jamb seals and extruded-vinyl blade-edge seals on each blade.
2. Self-lubricating stainless steel or synthetic sleeve bearings.
3. Comply with ASHRAE Std 90.1 I-P for rated maximum leakage rate.
4. Provide leakage testing and pressure ratings in compliance with AMCA 500-D test methods.
5. Arrange in parallel or opposed-blade configuration.

C. Barometric Relief Dampers:
1. Frame: Roll formed galvanized steel.
2. Blades: Roll formed galvanized steel.
3. Blade Seals: Extruded vinyl, mechanically attached to the blade edge.
4. Material:

2.7 CONTROLS

A. Combination VFD - Disconnects:
1. Provide factory mounted, combination VFD - disconnect for each fan motor.

B. Factory Installed Direct Digital Control (DDC) System:
1. Refer to DDC Section.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Bolt sections together with gaskets.

C. Isolate fan section with flexible duct connections.

D. Install assembled unit on vibration isolators. Install isolated fans with resilient mountings and flexible electrical leads. Install restraining snubbers as indicated. Refer to Section 22 0548. Adjust snubbers to prevent tension in flexible connectors when fan is operating.

E. Provide fixed sheaves required for final air balance.

F. Make connections to coils with unions or flanges.

G. Hydronic Coils:
1. Hydronic Coils: Connect water supply to leaving air side of coil (counterflow arrangement).
2. Provide shut-off valve on supply line and lockshield balancing valve with memory stop on return line.

3. Locate water supply at bottom of supply header and return water connection at top.
4. Provide manual air vents at high points complete with stop valve.
5. Ensure water coils are drainable and provide drain connection at low points.

H. Cooling Coils:
1. Pipe drain and overflow to nearest drain.

3.2 SYSTEM STARTUP

A. Provide manufacturer's field representative to perform systems startup.

B. Adjust for proper operation within manufacturer's published tolerances.

3.3 CLOSEOUT ACTIVITIES

A. Training: Train Owner's personnel on operation and maintenance of system.
1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of two hours of training.

END OF SECTION

SECTION 23 8126.13 - SMALL-CAPACITY SPLIT-SYSTEM AIR CONDITIONERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Air-source heat pumps.

B. Air cooled condensing units.

C. Indoor air handling (fan and coil) units for ducted systems.

D. Controls.

1.2 REFERENCE STANDARDS

A. AHRI 210/240 - Standard for Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2008, Including All Addenda.

B. AHRI 520 - Performance Rating of Positive Displacement Condensing Units; 2004.

C. ASHRAE Std 23.1 - Methods of Testing for Rating the Performance of Positive Displacement Refrigerant Compressors and Condensing Units that Operate at Subcritical Temperatures of the Refrigerant; 2010.

D. NEMA MG 1 - Motors and Generators; 2018.

E. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2018.

F. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2018.

G. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical; Current Edition, Including All Revisions.

1.3 SUBMITTALS

A. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

B. Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.

C. Design Data: Indicate refrigerant pipe sizing.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. LG.

2.2 SYSTEM DESIGN

A. Split-System Heating and Cooling Units: Self-contained, packaged, matched factory-engineered and assembled, pre-wired indoor and outdoor units; UL listed.
   1. Heating and Cooling: Air-source electric heat pump located in outdoor unit with evaporator.
   2. Provide refrigerant lines internal to units and between indoor and outdoor units, factory cleaned, dried, pressurized and sealed, with insulated suction line.

B. Performance Requirements: See Drawings for additional requirements.

2.3 INDOOR AIR HANDLING UNITS FOR DUCTED SYSTEMS

A. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heating and cooling element(s), controls, and accessories; wired for single power connection with control transformer.
   1. Air Flow Configuration: Upflow.
   2. Cabinet: Steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner.

B. Supply Fan: Centrifugal type rubber mounted with direct or belt drive with adjustable variable pitch motor pulley.
   1. Motor: NEMA MG 1; 1750 rpm single speed, permanently lubricated, hinge mounted.
   2. Motor Electrical Characteristics:

C. Air Filters: 1 inch (25 mm) thick urethane, washable type arranged for easy replacement.

D. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.
   1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.

2. Manufacturers: System manufacturer.

2.4 OUTDOOR UNITS

A. Outdoor Units: Self-contained, packaged, pre-wired unit consisting of cabinet, with compressor and condenser.
   1. Construction and Ratings: In accordance with AHRI 210/240 with testing in accordance with ASHRAE Std 23.1 and UL 207.

B. Air Cooled Condenser: Aluminum fin and copper tube coil, AHRI 520 with direct drive axial propeller fan resiliently mounted, galvanized fan guard.

C. Accessories: Filter drier, high pressure switch (manual reset), low pressure switch (automatic reset), service valves and gauge ports, thermometer well (in liquid line).
   1. Provide thermostatic expansion valves.

D. Operating Controls:
   1. Control by room thermostat to maintain room temperature setting.

2.5 ACCESSORY EQUIPMENT

A. Room Thermostat: Wall-mounted, electric solid state microcomputer based room thermostat with remote sensor to maintain temperature setting; low-voltage; with following features:
   1. Automatic switching from heating to cooling.
   2. Preferential rate control to minimize overshoot and deviation from setpoint.
   3. Thermostat Display:
      a. Actual room temperature.
      b. System Mode Indication: Heating, Cooling, Fan Auto, Off, and On, Auto or On, Off.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrates are ready for installation of units and openings are as indicated on shop drawings.

B. Verify that proper power supply is available and in correct location.

C. Verify that proper fuel supply is available for connection.

3.2 INSTALLATION

A. Install in accordance with NFPA 90A and NFPA 90B.

B. Pipe drain from cooling coils to nearest floor drain.

END OF SECTION

SECTION 26 0519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 2 PRODUCTS

2.1 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

D. Comply with NEMA WC 70.

E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

G. Conductor Material:
   1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
   2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
   3. Tinned Copper Conductors: Comply with ASTM B33.

H. Minimum Conductor Size:
   1. Branch Circuits: 12 AWG.
   2. Control Circuits: 14 AWG.

I. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

J. Conductor Color Coding:
   1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
   2. Color Coding Method: Integrally colored insulation.
   3. Color Code:
      a. 208Y/120 V, 3 Phase, 4 Wire System:
         1 Phase A: Black.
         2 Phase B: Red.
         3 Phase C: Blue.
         4 Neutral/Grounded: White.
      b. Equipment Ground, All Systems: Green.

2.2 SINGLE CONDUCTOR BUILDING WIRE

A. Manufacturers:
   1. Copper Building Wire:
      a. Cerro Wire LLC: www.cerrowire.com/#sle.
      b. Encore Wire Corporation: www.encorewire.com/#sle.
      c. General Cable Technologies Corporation; _____: www.generalcable.com/#sle.
      d. Southwire Company: www.southwire.com/#sle.

B. Description: Single conductor insulated wire.

C. Conductor Stranding:
   1. Feeders and Branch Circuits:
      a. Size 10 AWG and Smaller: Solid.
      b. Size 8 AWG and Larger: Stranded.
   2. Control Circuits: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation:
   1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
      a. Size 4 AWG and Larger: Type XHHW-2.
      b. Installed Underground: Type XHHW-2.

2.3 SERVICE ENTRANCE CABLE

A. Manufacturers:
   1. Copper Service Entrance Cable:
      a. Cerro Wire LLC: www.cerrowire.com/#sle.
      b. Encore Wire Corporation: www.encorewire.com/#sle.
      c. Southwire Company: www.southwire.com/#sle.

B. Service Entrance Cable for Above-Ground Use: NFPA 70, Type SE multiple-conductor cable listed and labeled as complying with UL 854, Style R.

C. Conductor Stranding: Stranded.

D. Insulation Voltage Rating: 600 V.

2.4 ARMORED CABLE

A. Manufacturers:
   1. AFC Cable Systems Inc: www.afcweb.com/#sle.
   2. Encore Wire Corporation: www.encorewire.com/#sle.
   3. Southwire Company: www.southwire.com/#sle.

B. Description: NFPA 70, Type AC cable listed and labeled as complying with UL 4, and listed for use in classified firestop systems to be used.

C. Conductor Stranding:
   1. Size 10 AWG and Smaller: Solid.
   2. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation: Type THHN or THWN-2.

F. Grounding: Combination of interlocking armor and integral bonding wire.

G. Armor: Steel, interlocked tape.

2.5 POWER AND CONTROL TRAY CABLE

A. Manufacturers:
   1. Encore Wire Corporation: www.encorewire.com/#sle.
   2. General Cable Technologies Corporation: www.generalcable.com/#sle.
   3. Okonite: www.okonite.com/#sle.
   4. Southwire Company: www.southwire.com/#sle.

B. Description: NFPA 70, Type TC cable listed and labeled as complying with UL 1277.

C. Conductor Stranding: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation: Type XHHW or XHHW-2.

F. Jacket: PVC or Chlorinated Polyethylene (CPE).

2.6 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Connectors for Grounding and Bonding: Comply with Section 26 0526.

C. Wiring Connectors for Splices and Taps:
   1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
   2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.

D. Wiring Connectors for Terminations:
   1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
   2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
   3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
   4. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.

5. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
6. Conductors for Control Circuits: Use crimped terminals for all connections.

E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.

F. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F (105 degrees C) for standard applications and 302 degrees F (150 degrees C) for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.

G. Mechanical Connectors: Provide bolted type or set-screw type.
1. Manufacturers:
a. Burndy LLC: www.burndy.com/#sle.
b. Ilsco: www.ilsco.com/#sle.
c. Thomas & Betts Corporation: www.tnb.com/#sle.

H. Compression Connectors: Provide circumferential type or hex type crimp configuration.

I. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.
1. Manufacturers:
a. Burndy LLC: www.burndy.com/#sle.
b. Ilsco: www.ilsco.com/#sle.
c. Thomas & Betts Corporation: www.tnb.com/#sle.

2.7 ACCESSORIES

A. Electrical Tape:
1. Manufacturers:
a. 3M: www.3m.com/#sle.
b. Plymouth Rubber Europa: www.plymouthrubber.com/#sle.
2. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
3. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F (-18 degrees C) and suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
4. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil (0.76 mm); suitable for continuous temperature environment up to 194 degrees F (90 degrees C) and short-term 266 degrees F (130 degrees C) overload service.
5. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil (3.2 mm); suitable for continuous temperature environment up to 176 degrees F (80 degrees C).
6. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil (2.3 mm).

B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.

C. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.
1. Manufacturers:
a. Burndy LLC: www.burndy.com/#sle.
b. Ideal Industries, Inc: www.idealindustries.com/#sle.
c. Ilsco: www.ilsco.com/#sle.

D. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.
1. Manufacturers:
a. 3M: www.3m.com/#sle.
b. American Polywater Corporation: www.polywater.com/#sle.
c. Ideal Industries, Inc: www.idealindustries.com/#sle.

E. Cable Ties: Material and tensile strength rating suitable for application.
1. Manufacturers:
a. Burndy LLC: www.burndy.com/#sle.

F. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for cables and roofing system to be installed; designed to accommodate existing penetrations where applicable.

1. Products:
   a. Menzies Metal Products; Electrical Roof Stack and Cap: www.menzies-metal.com/#sle.
   b. Menzies Metal Products; Electrical Retro Box: www.menzies-metal.com/#sle.

G. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.
   1. Products:
      a. HoldRite, a brand of Reliance Worldwide Corporation; HydroFlame Pro Series/HydroFlame Custom Built: www.holdrite.com/#sle.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.3 INSTALLATION

A. Circuiting Requirements:
   1. Unless dimensioned, circuit routing indicated is diagrammatic.
   2. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
   3. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
   4. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is not permitted.
   5. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.

B. Install products in accordance with manufacturer's instructions.

C. Perform work in accordance with NECA 1 (general workmanship).

D. Install armored cable (Type AC) in accordance with NECA 120.

E. Install metal-clad cable (Type MC) in accordance with NECA 120.

F. Installation in Raceway:
   1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
   2. Pull all conductors and cables together into raceway at same time.
   3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
   4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

G. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

H. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
   1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
   2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.

I. Terminate cables using suitable fittings.
   1. Armored Cable (Type AC):
      a. Use listed fittings and anti-short, insulating bushings.
      b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.
   2. Metal-Clad Cable (Type MC):
      a. Use listed fittings.
      b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.

J. Install conductors with a minimum of 12 inches (300 mm) of slack at each outlet.

K. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet (1.5 m) of slack.

L. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

M. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

N. Make wiring connections using specified wiring connectors.
   1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
   2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
   3. Do not remove conductor strands to facilitate insertion into connector.
   4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
   5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
   6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

O. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
   1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
      a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.
   2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
      a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
      b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.

P. Insulate ends of spare conductors using vinyl insulating electrical tape.

Q. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

R. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.4 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.

D. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION

SECTION 26 0526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

D. Ground bars.

E. Ground rod electrodes.

1.2 RELATED REQUIREMENTS

A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.

B. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System; 2012.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings; 2017.

D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2017.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittals procedures.

B. Shop Drawings:

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Field quality control test reports.

1.5 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.1 GROUNDING AND BONDING REQUIREMENTS

A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.

B. Do not use products for applications other than as permitted by NFPA 70 and product listing.

C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

D. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

E. Grounding Electrode System:

1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
    a. Provide continuous grounding electrode conductors without splice or joint.

b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.

2. Metal Underground Water Pipe(s):
   a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet (3.0 m) at an accessible location not more than 5 feet (1.5 m) from the point of entrance to the building.
   b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
   c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
3. Metal In-Ground Support Structure:
   a. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.

F. Service-Supplied System Grounding:
1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.

G. Bonding and Equipment Grounding:
1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
   a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
   b. Metal gas piping.
   c. Metal process piping.
8. Provide bonding for interior metal air ducts.
9. Provide bonding for metal building frame.

H. Communications Systems Grounding and Bonding:
1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.
2. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
   a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.
   b. Raceway Size: 3/4 inch (21 mm) trade size unless otherwise indicated or required.
   c. Ground Bar Size: 1/4 by 2 by 12 inches (6 by 50 by 300 mm) unless otherwise indicated or required.

2.2 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
1. Provide products listed, classified, and labeled as suitable for the purpose intended.
2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 0526:
1. Use insulated copper conductors unless otherwise indicated.
   a. Exceptions:
      1 Use bare copper conductors where installed underground in direct contact with earth.

2 Use bare copper conductors where directly encased in concrete (not in raceway).

2. Factory Pre-fabricated Bonding Jumpers: Furnished with factory-installed ferrules; size braided cables to provide equivalent gage of specified conductors.

C. Connectors for Grounding and Bonding:
1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
a. Exceptions:
3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
4. Manufacturers - Mechanical and Compression Connectors:
a. Advanced Lightning Technology (ALT): www.altfab.com/#sle.
b. Burndy LLC: www.burndy.com/#sle.
c. Harger Lightning & Grounding: www.harger.com/#sle.
d. Thomas & Betts Corporation: www.tnb.com/#sle.
5. Manufacturers - Exothermic Welded Connections:
a. Burndy LLC: www.burndy.com/#sle.
b. Cadweld, a brand of Erico International Corporation: www.erico.com/#sle.
c. ThermOweld, subsidiary of Continental Industries; division of Burndy LLC: www.thermoweld.com/#sle.

D. Ground Bars:
1. Description: Copper rectangular ground bars with mounting brackets and insulators.
2. Size: As indicated.
3. Holes for Connections: As indicated or as required for connections to be made.

E. Ground Rod Electrodes:
1. Comply with NEMA GR 1.
2. Material: Copper-bonded (copper-clad) steel.
3. Size: 3/4 inch (19 mm) diameter by 10 feet (3.0 m) length, unless otherwise indicated.
4. Where rod lengths of greater than 10 feet (3.0 m) are indicated or otherwise required, sectionalized ground rods may be used.
5. Manufacturers:
a. Advanced Lightning Technology (ALT): www.altfab.com/#sle.
b. Erico International Corporation: www.erico.com/#sle.
c. Galvan Industries, Inc: www.galvanelectrical.com/#sle.
d. Harger Lightning & Grounding: www.harger.com/#sle.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as indicated.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.
1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches (150 mm) below finished grade.

D. Make grounding and bonding connections using specified connectors.
1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.

4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

E. Identify grounding and bonding system components in accordance with Section 26 0553.

3.3 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.13.

D. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

E. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

F. Submit detailed reports indicating inspection and testing results and corrective actions taken.

END OF SECTION

SECTION 26 0529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.2 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 05 5000 - Metal Fabrications: Materials and requirements for fabricated metal supports.

C. Section 26 0533.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.

D. Section 26 0533.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.

E. Section 26 5100 - Interior Lighting: Additional support and attachment requirements for interior luminaires.

F. Section 26 5600 - Exterior Lighting: Additional support and attachment requirements for exterior luminaires.

1.3 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2019.

D. MFMA-4 - Metal Framing Standards Publication; 2004.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 5B - Strut-Type Channel Raceways and Fittings; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.5 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with applicable building code.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
   2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
   3. Do not use products for applications other than as permitted by NFPA 70 and product listing.
   4. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
   5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
      a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.

b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
2. Conduit Clamps: Bolted type unless otherwise indicated.
3. Manufacturers:
a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com/#sle.
b. Erico International Corporation: www.erico.com/#sle.
c. HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com/#sle.
d. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
e. Thomas & Betts Corporation: www.tnb.com/#sle.

C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.
1. Manufacturers:
a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com/#sle.
b. Erico International Corporation: www.erico.com/#sle.
c. HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com/#sle.
d. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
e. Thomas & Betts Corporation: www.tnb.com/#sle.

D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
1. Comply with MFMA-4.
2. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch (2.66 mm).
3. Minimum Channel Dimensions: 1-5/8 inch (41 mm) width by 13/16 inch (21 mm) height.
4. Manufacturers:
a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com/#sle.
b. Thomas & Betts Corporation: www.tnb.com/#sle.
c. Unistrut, a brand of Atkore International Inc: www.unistrut.com/#sle.
d. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.

E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
1. Minimum Size, Unless Otherwise Indicated or Required:
a. Equipment Supports: 1/2 inch (13 mm) diameter.
b. Single Conduit up to 1 inch (27 mm) trade size: 1/4 inch (6 mm) diameter.
c. Single Conduit larger than 1 inch (27 mm) trade size: 3/8 inch (10 mm) diameter.
d. Trapeze Support for Multiple Conduits: 3/8 inch (10 mm) diameter.
e. Outlet Boxes: 1/4 inch (6 mm) diameter.
f. Luminaires: 1/4 inch (6 mm) diameter.

F. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
4. Hollow Masonry: Use toggle bolts.
5. Hollow Stud Walls: Use toggle bolts.
6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
7. Sheet Metal: Use sheet metal screws.
8. Wood: Use wood screws.
9. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
a. Comply with MFMA-4.
b. Channel Material: Use galvanized steel.
c. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch (2.66 mm) minimum base metal thickness.
d. Manufacturer: Same as manufacturer of metal channel (strut) framing system.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

D. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

E. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

F. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

G. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

H. Field-Welding (where approved by Architect): Comply with Section 05 5000.

I. Equipment Support and Attachment:
   1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
   2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 3 inch (80 mm) high concrete pad constructed in accordance with Section 03 3000.
   5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

J. Conduit Support and Attachment: Also comply with Section 26 0533.13.

K. Box Support and Attachment: Also comply with Section 26 0533.16.

L. Interior Luminaire Support and Attachment: Also comply with Section 26 5100.

M. Exterior Luminaire Support and Attachment: Also comply with Section 26 5600.

N. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

O. Secure fasteners according to manufacturer's recommended torque settings.

P. Remove temporary supports.

Q. Identify independent electrical component support wires above accessible ceilings (only where specifically indicated or permitted) with color distinguishable from ceiling support wires in accordance with NFPA 70.

3.3 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 26 0533.13 - CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).

B. Flexible metal conduit (FMC).

C. Liquidtight flexible metal conduit (LFMC).

D. Electrical metallic tubing (EMT).

E. Liquidtight flexible nonmetallic conduit (LFNC).

F. Conduit fittings.

G. Accessories.

1.2 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete encasement of conduits.

B. Section 07 8400 - Firestopping.

C. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Metal clad cable (Type MC), armored cable (Type AC), and manufactured wiring systems, including uses permitted.

D. Section 26 0526 - Grounding and Bonding for Electrical Systems.
   1. Includes additional requirements for fittings for grounding and bonding.

E. Section 26 0529 - Hangers and Supports for Electrical Systems.

F. Section 26 0533.16 - Boxes for Electrical Systems.

G. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

H. Section 26 2100 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conduits.

I. Section 27 1000 - Structured Cabling: Additional requirements for communications systems conduits.

1.3 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2015.

B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2015.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

D. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2013.

E. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2003.

F. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit; 2018.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

I. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

J. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.

K. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

L. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

M. UL 1660 - Liquid-Tight Flexible Nonmetallic Conduit; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.

4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

C. Shop Drawings:
1. Include proposed locations of roof penetrations and proposed methods for sealing.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.

C. Concealed Within Hollow Stud Walls: Use electrical metallic tubing (EMT).

D. Concealed Above Accessible Ceilings: Use electrical metallic tubing (EMT).

E. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit.

F. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit.

G. Exposed, Exterior: Use galvanized steel rigid metal conduit.

H. Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit.
1. Maximum Length: 6 feet (1.8 m).

I. Connections to Vibrating Equipment:
1. Dry Locations: Use flexible metal conduit.
2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
3. Maximum Length: 6 feet (1.8 m) unless otherwise indicated.
4. Vibrating equipment includes, but is not limited to:
a. Transformers.
b. Motors.

2.2 CONDUIT REQUIREMENTS

A. Electrical Service Conduits: Also comply with Section 26 2100.

B. Communications Systems Conduits: Also comply with Section 27 1000.

C. Fittings for Grounding and Bonding: Also comply with Section 26 0526.

D. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

E. Provide products listed, classified, and labeled as suitable for the purpose intended.

F. Minimum Conduit Size, Unless Otherwise Indicated:
1. Branch Circuits: 3/4 inch (21 mm) trade size.
2. Branch Circuit Homeruns: 3/4 inch (21 mm) trade size.
3. Control Circuits: 3/4 inch (21 mm) trade size.
4. Flexible Connections to Luminaires: 3/8 inch (12 mm) trade size.
5. Underground, Interior: 3/4 inch (21 mm) trade size.
6. Underground, Exterior: 1 inch (27 mm) trade size.

G. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.3 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
   1. Allied Tube & Conduit: www.alliedeg.com/#sle.
   2. Republic Conduit: www.republic-conduit.com/#sle.
   3. Wheatland Tube, a Division of Zekelman Industries: www.wheatland.com/#sle.

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

C. Fittings:
   1. Manufacturers:
      a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
      b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.
   2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   3. Material: Use steel or malleable iron.
      a. Do not use die cast zinc fittings.
   4. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.4 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:
   1. AFC Cable Systems, Inc: www.afcweb.com/#sle.
   2. Electri-Flex Company: www.electriflex.com/#sle.
   3. International Metal Hose: www.metalhose.com/#sle.

B. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.

C. Fittings:
   1. Manufacturers:
      a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
      b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.
   2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   3. Material: Use steel or malleable iron.
      a. Do not use die cast zinc fittings.

2.5 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Manufacturers:
   1. AFC Cable Systems, Inc: www.afcweb.com/#sle.
   2. Electri-Flex Company: www.electriflex.com/#sle.
   3. International Metal Hose: www.metalhose.com/#sle.

B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

C. Fittings:
   1. Manufacturers:
      a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
      b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.
   2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   3. Material: Use steel or malleable iron.
      a. Do not use die cast zinc fittings.

2.6 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:
   1. Allied Tube & Conduit: www.alliedeg.com/#sle.
   2. Republic Conduit: www.republic-conduit.com/#sle.
   3. Wheatland Tube, a Division of Zekelman Industries: www.wheatland.com/#sle.

B. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

C. Fittings:
   1. Manufacturers:
      a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
      b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.
   2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   3. Material: Use steel or malleable iron.
      a. Do not use die cast zinc fittings.
   4. Connectors and Couplings: Use compression (gland) or set-screw type.
      a. Do not use indenter type connectors and couplings.
   5. Embedded Within Concrete (where permitted): Use fittings listed as concrete-tight. Fittings that require taping to be concrete-tight are acceptable.

2.7 LIQUIDTIGHT FLEXIBLE NONMETALLIC CONDUIT (LFNC)

A. Manufacturers:
   1. AFC Cable Systems, Inc: www.afcweb.com/#sle.
   2. Electri-Flex Company: www.electriflex.com/#sle.
   3. International Metal Hose: www.metalhose.com/#sle.

B. Description: NFPA 70, Type LFNC liquidtight flexible nonmetallic conduit listed and labeled as complying with UL 1660.

C. Fittings:
   1. Manufacturer: Same as manufacturer of conduit to be connected.
   2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B; suitable for the type of conduit to be connected.

2.8 ACCESSORIES

A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil (0.51 mm).

B. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.

C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

D. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force (890 N).

E. Sealing Compound for Sealing Fittings: Listed for use with the particular fittings to be installed.

F. Modular Seals for Conduit Penetrations: Rated for minimum of 40 psig; Suitable for the conduits to be installed.

G. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.
   1. Products:
      a. Menzies Metal Products; Electrical Roof Stack and Cap: www.menzies-metal.com/#sle.
      b. Menzies Metal Products; Electrical Retro Box: www.menzies-metal.com/#sle.

H. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.
   1. Manufacturers:
      a. Quickflash Weatherproofing Products, Inc: www.quickflashproducts.com/#sle.

I. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.
   1. Products:
      a. HoldRite, a brand of Reliance Worldwide Corporation; HydroFlame Pro Series/HydroFlame Custom Built: www.holdrite.com/#sle.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.

D. Install liquidtight flexible nonmetallic conduit (LFNC) in accordance with NECA 111.

E. Conduit Routing:
   1. Unless dimensioned, conduit routing indicated is diagrammatic.
   2. Conceal all conduits unless specifically indicated to be exposed.
   3. Conduits in the following areas may be exposed, unless otherwise indicated:
      a. Electrical rooms.
      b. Mechanical equipment rooms.
      c. Within joists in areas with no ceiling.
   4. Unless otherwise approved, do not route conduits exposed:
      a. Across floors.
      b. Across roofs.
      c. Across top of parapet walls.
      d. Across building exterior surfaces.
   5. Arrange conduit to maintain adequate headroom, clearances, and access.
   6. Arrange conduit to provide no more than the equivalent of three 90 degree bends between pull points.
   7. Arrange conduit to provide no more than 150 feet (46 m) between pull points.
   8. Route conduits above water and drain piping where possible.
   9. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
   10. Maintain minimum clearance of 6 inches (150 mm) between conduits and piping for other systems.
   11. Maintain minimum clearance of 12 inches (300 mm) between conduits and hot surfaces. This includes, but is not limited to:
      a. Heaters.
      b. Hot water piping.
      c. Flues.

F. Conduit Support:
   1. Secure and support conduits in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
   2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
   3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
   4. Use conduit strap to support single surface-mounted conduit.
      a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
   5. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
   6. Use conduit clamp to support single conduit from beam clamp or threaded rod.
   7. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.
   8. Use non-penetrating rooftop supports to support conduits routed across rooftops (only where approved).
   9. Use of spring steel conduit clips for support of conduits is not permitted.
   10. Use of wire for support of conduits is not permitted.
      a. For securing conduits to studs in hollow stud walls.
      b. For suspending conduits supported by spring steel conduit clips (only where specifically indicated or permitted).
   11. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with the most stringent requirements.

G. Connections and Terminations:
   1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
   2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.

3. Use suitable adapters where required to transition from one type of conduit to another.
4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
6. Where spare conduits stub up through concrete floors and are not terminated in a box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.
7. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
8. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

H. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
6. Provide suitable modular seal where conduits penetrate exterior wall below grade.
7. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
8. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
9. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

I. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where conduits are subject to earth movement by settlement or frost.

J. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches (300 mm) at each end.

K. Provide grounding and bonding in accordance with Section 26 0526.

L. Identify conduits in accordance with Section 26 0553.

3.3 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.

D. Correct deficiencies and replace damaged or defective conduits.

3.4 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

3.5 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION

SECTION 26 0533.16 - BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches (1,650 cu cm), including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches (1,650 cu cm).

C. Boxes and enclosures for integrated power, data, and audio/video.

D. Accessories.

1.2 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete.

B. Section 07 8400 - Firestopping.

C. Section 08 3100 - Access Doors and Panels: Panels for maintaining access to concealed boxes.

D. Section 26 0526 - Grounding and Bonding for Electrical Systems.

E. Section 26 0529 - Hangers and Supports for Electrical Systems.

F. Section 26 0533.13 - Conduit for Electrical Systems:
   1. Conduit bodies and other fittings.
   2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.

G. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

H. Section 26 2726 - Wiring Devices:
   1. Wall plates.
   2. Additional requirements for locating boxes for wiring devices.

I. Section 27 1000 - Structured Cabling: Additional requirements for communications systems outlet boxes.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.

C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013.

E. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; 2013.

F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2018.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

I. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

J. UL 508A - UL Standard for Safety Industrial Control Panels; 2018.

K. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

L. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.

4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 BOXES

A. General Requirements:
1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
3. Provide products listed, classified, and labeled as suitable for the purpose intended.
4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches (1,650 cu cm), Including Those Used as Junction and Pull Boxes:
1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
3. Use cast iron boxes or cast aluminum boxes where exposed galvanized steel rigid metal conduit or exposed intermediate metal conduit (IMC) is used.
4. Use suitable concrete type boxes where flush-mounted in concrete.
5. Use suitable masonry type boxes where flush-mounted in masonry walls.
6. Use raised covers suitable for the type of wall construction and device configuration where required.
7. Use shallow boxes where required by the type of wall construction.
8. Do not use "through-wall" boxes designed for access from both sides of wall.
9. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
10. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
11. Nonmetallic Boxes: Comply with NEMA OS 2, and list and label as complying with UL 514C.
12. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
13. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gang able boxes unless specifically indicated or permitted.
14. Minimum Box Size, Unless Otherwise Indicated:
    a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
    b. Communications Systems Outlets: 4 inch square by 2-1/8 inch (100 by 54 mm) trade size.
15. Wall Plates: Comply with Section 26 2726.
16. Manufacturers:

a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com/#sle.
b. Hubbell Incorporated; Bell Products: www.hubbell-rtb.com/#sle.
c. Hubbell Incorporated; RACO Products: www.hubbell-rtb.com/#sle.
d. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
e. Thomas & Betts Corporation: www.tnb.com/#sle.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA 250 Environment Type, Unless Otherwise Indicated:
3. Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
b. Boxes 6 square feet (0.56 sq m) and Larger: Provide sectionalized screw-cover or hinged-cover enclosures.
4. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.
5. Manufacturers:
a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com/#sle.
b. Hoffman, a brand of Pentair Technical Products: www.hoffmanonline.com/#sle.
c. Hubbell Incorporated; Wiegmann Products: www.hubbell-wiegmann.com/#sle.

D. Boxes and Enclosures for Integrated Power, Data, and Audio/Video: Size and configuration as indicated or as required with partitions to separate services; field-connected gang able boxes may be used.
1. Manufacturers:
a. Hubbell Incorporated: www.hubbell.com/#sle.

2.2 ACCESSORIES

A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for boxes and facade materials to be installed.
1. Manufacturers:
a. Quickflash Weatherproofing Products, Inc: www.quickflashproducts.com/#sle.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide separate boxes for emergency power and normal power systems.

E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

H. Box Locations:
1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 3100 as required where approved by the Architect.
2. Unless dimensioned, box locations indicated are approximate.
3. Locate boxes as required for devices installed under other sections or by others.
a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26 2726.
b. Communications Systems Outlets: Comply with Section 27 1000.
4. Locate boxes so that wall plates do not span different building finishes.
5. Locate boxes so that wall plates do not cross masonry joints.
6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.

7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches (150 mm) horizontal separation unless otherwise indicated.
8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches (610 mm) horizontal separation.
9. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
    a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches (610 mm) separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
    b. Do not install flush-mounted boxes with area larger than 16 square inches (0.0103 sq m) or such that the total aggregate area of openings exceeds 100 square inches (0.0645 sq m) for any 100 square feet (9.29 sq m) of wall area.
10. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 0533.13.
11. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
    a. Concealed above accessible suspended ceilings.
    b. Electrical rooms.
    c. Mechanical equipment rooms.

I. Box Supports:
1. Secure and support boxes in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
4. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.

J. Install boxes plumb and level.

K. Flush-Mounted Boxes:
1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch (6 mm) or does not project beyond finished surface.
2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch (3 mm) at the edge of the box.

L. Floor-Mounted Cabinets: Mount on properly sized 3 inch (80 mm) high concrete pad constructed in accordance with Section 03 3000.

M. Install boxes as required to preserve insulation integrity.

N. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

O. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

P. Close unused box openings.

Q. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

R. Provide grounding and bonding in accordance with Section 26 0526.

S. Identify boxes in accordance with Section 26 0553.

3.3 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.4 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION

SECTION 26 0553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

D. Voltage markers.

E. Warning signs and labels.

1.2 RELATED REQUIREMENTS

A. Section 09 9113 - Exterior Painting.

B. Section 09 9123 - Interior Painting.

C. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

D. Section 26 2726 - Wiring Devices - Lutron: Device and wall plate finishes; factory pre-marked wall plates.

E. Section 27 1000 - Structured Cabling: Identification for communications cabling and devices.

1.3 REFERENCE STANDARDS

A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2011.

B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2011.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. NFPA 70E - Standard for Electrical Safety in the Workplace; 2018.

E. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

B. Sequencing:
   1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
   2. Do not install identification products until final surface finishes and painting are complete.

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittals procedures.

B. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.7 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.1 IDENTIFICATION REQUIREMENTS

A. Identification for Equipment:
   1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
      a. Panelboards:

1 Identify ampere rating.
2 Identify voltage and phase.
3 Identify power source and circuit number. Include location when not within sight of equipment.
4 Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
5 For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.

b. Enclosed switches, circuit breakers, and motor controllers:
1 Identify voltage and phase.
2 Identify power source and circuit number. Include location when not within sight of equipment.

2. Service Equipment:
a. Use identification nameplate to identify each service disconnecting means.
b. For buildings or structures supplied by more than one service, or any combination of branch circuits, feeders, and services, use identification nameplate or means of identification acceptable to authority having jurisdiction at each service disconnecting means to identify all other services, feeders, and branch circuits supplying that building or structure. Verify format and descriptions with authority having jurisdiction.
3. Use voltage marker to identify highest voltage present for each piece of electrical equipment.
4. Use identification nameplate to identify equipment utilizing series ratings, where permitted, in accordance with NFPA 70.
5. Use identification nameplate to identify switchboards and panelboards utilizing a high leg delta system in accordance with NFPA 70.
6. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.
7. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
8. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70, including but not limited to the following.
a. Service equipment.
b. Industrial control panels.
c. Motor control centers.
d. Elevator control panels.
e. Industrial machinery.
9. Use warning signs to identify electrical hazards for entrances to all buildings, vaults, rooms, or enclosures containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".

B. Identification for Conductors and Cables:
1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 0519.
2. Identification for Communications Conductors and Cables: Comply with Section 27 1000.
3. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
4. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
a. At each source and load connection.
b. Within equipment enclosures when conductors and cables enter or leave the enclosure.

C. Identification for Raceways:
1. Use voltage markers to identify highest voltage present for accessible conduits at maximum intervals of 20 feet (6.1 m).
2. Use voltage markers or color-coded bands to identify systems other than normal power system for accessible conduits at maximum intervals of 20 feet (6.1 m).
a. Color-Coded Bands: Use field-painting or vinyl color coding electrical tape to mark bands 3 inches (76 mm) wide.
1 Color Code:
a Emergency Power System: Red.
b Fire Alarm System: Red.
2 Field-Painting: Comply with Section 09 9123 and 09 9113.

3 Vinyl Color Coding Electrical Tape: Comply with Section 26 0519.

D. Identification for Boxes:
1. Use voltage markers to identify highest voltage present.

E. Identification for Devices:
1. Identification for Communications Devices: Comply with Section 27 1000.

2.2 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
1. Manufacturers:
a. Brimar Industries, Inc: www.brimar.com/#sle.
b. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
c. Seton Identification Products: www.seton.com/#sle.
2. Materials:
a. Indoor Clean, Dry Locations: Use plastic nameplates.
b. Outdoor Locations: Use aluminum nameplates suitable for exterior use.
3. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch (1.6 mm); engraved text.
4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch (0.8 mm); engraved or laser-etched text.
5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch (25 mm) high; Four, located at corners for larger sizes.

B. Identification Labels:
1. Manufacturers:
a. Brady Corporation: www.bradyid.com/#sle.
b. Brother International Corporation: www.brother-usa.com/#sle.
c. Panduit Corp: www.panduit.com/#sle.
2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
a. Use only for indoor locations.
3. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:
1. Minimum Size: 1 inch (25 mm) by 2.5 inches (64 mm).
2. Legend:
a. System designation where applicable:
1 Emergency Power System: Identify with text "EMERGENCY".
2 Fire Alarm System: Identify with text "FIRE ALARM".
b. Equipment designation or other approved description.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height:
a. System Designation: 1 inch (25 mm).
b. Equipment Designation: 1/2 inch (13 mm).
5. Color:
a. Normal Power System: White text on black background.
b. Emergency Power System: White text on red background.
c. Fire Alarm System: White text on red background.

D. Format for Caution and Warning Messages:
1. Minimum Size: 2 inches (51 mm) by 4 inches (100 mm).
2. Text: All capitalized unless otherwise indicated.
3. Minimum Text Height: 1/2 inch (13 mm).
4. Color: Black text on yellow background unless otherwise indicated.

E. Format for Fire Alarm Device Identification:
1. Minimum Size: 3/8 inch (10 mm) by 1.5 inches (38 mm).
2. Legend: Designation indicated and device zone or address.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch (5 mm).
5. Color: Red text on white background.

2.3 WIRE AND CABLE MARKERS

A. Manufacturers:

1. Brady Corporation: www.bradyid.com/#sle.
2. HellermannTyton: www.hellermanntyton.com/#sle.
3. Panduit Corp: www.panduit.com/#sle.

B. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl self-laminating type markers suitable for the conductor or cable to be identified.

C. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

D. Legend: Power source and circuit number or other designation indicated.

E. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.
1. Do not use handwritten text.

F. Minimum Text Height: 1/8 inch (3 mm).

G. Color: Black text on white background unless otherwise indicated.

2.4 VOLTAGE MARKERS

A. Manufacturers:
1. Brady Corporation: www.bradyid.com/#sle.
2. Brimar Industries, Inc: www.brimar.com/#sle.
3. Seton Identification Products: www.seton.com/#sle.

B. Markers for Conduits: Use factory pre-printed self-adhesive vinyl type markers.

C. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.

D. Minimum Size:
1. Markers for Equipment: 1 1/8 by 4 1/2 inches (29 by 110 mm).
2. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.
3. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches (29 by 110 mm).
4. Markers for Junction Boxes: 1/2 by 2 1/4 inches (13 by 57 mm).

E. Legend:
1. Markers for Voltage Identification: Highest voltage present.
2. Markers for System Identification:
a. Emergency Power System: Text "EMERGENCY".

F. Color: Black text on orange background unless otherwise indicated.

2.5 WARNING SIGNS AND LABELS

A. Manufacturers:
1. Brimar Industries, Inc: www.brimar.com/#sle.
2. Clarion Safety Systems, LLC: www.clarionsafety.com/#sle.
3. Seton Identification Products: www.seton.com/#sle.

B. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

C. Warning Signs:
1. Materials:
a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
3. Minimum Size: 7 by 10 inches (178 by 254 mm) unless otherwise indicated.

D. Warning Labels:
1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
a. Do not use labels designed to be completed using handwritten text.
2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
3. Minimum Size: 2 by 4 inches (51 mm by 102 mm) unless otherwise indicated.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
   1. Surface-Mounted Equipment: Enclosure front.
   2. Flush-Mounted Equipment: Inside of equipment door.
   3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
   4. Elevated Equipment: Legible from the floor or working platform.
   5. Branch Devices: Adjacent to device.
   6. Interior Components: Legible from the point of access.
   7. Conduits: Legible from the floor.
   8. Boxes: Outside face of cover.
   9. Conductors and Cables: Legible from the point of access.
   10. Devices: Outside face of cover.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.
   1. Do not use adhesives on exterior surfaces except where substrate cannot be penetrated.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Secure rigid signs using stainless steel screws.

G. Mark all handwritten text, where permitted, to be neat and legible.

3.3 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION

SECTION 26 0923 - LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Occupancy sensors.

B. Outdoor photo controls.

C. Lighting contactors.

D. Accessories.

1.2 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 0533.16 - Boxes for Electrical Systems.

D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 2726 - Wiring Devices: Devices for manual control of lighting, including wall switches, wall dimmers, and fan speed controllers.
   1. Includes finish requirements for wall controls specified in this section.

F. Section 26 5100 - Interior Lighting.

1.3 REFERENCE STANDARDS

A. ANSI C136.24 - American National Standard for Roadway and Area Lighting Equipment - Nonlocking (Button) Type Photocontrols; 2004 (R2010).

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

C. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2018.

E. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2016.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 773A - Nonindustrial Photoelectric Switches for Lighting Control; Current Edition, Including All Revisions.

H. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.
   2. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.
   3. Coordinate the placement of occupancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.
   4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Sequencing:
   1. Do not install lighting control devices until final surface finishes and painting are complete.

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
   1. Occupancy Sensors: Include detailed motion detection coverage range diagrams.

C. Shop Drawings:
   1. Occupancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.

D. Field Quality Control Reports.

E. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Operation and Maintenance Data: Include detailed information on device programming and setup.

G. Project Record Documents: Record actual installed locations and settings for lighting control devices.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.8 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.9 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for all occupancy sensors.

PART 2 PRODUCTS

2.1 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

C. Products for Switching of Electronic Ballasts/Drivers: Tested and rated to be suitable for peak inrush currents specified in NEMA 410.

2.2 OCCUPANCY SENSORS

A. Manufacturers:
   1. Hubbell Incorporated: www.hubbell.com/#sle.
   2. Lutron Electronics Company, Inc: www.lutron.com/#sle.
   3. Sensor Switch Inc: www.sensorswitch.com/#sle.
   4. Watt Stopper: www.wattstopper.com/#sle.

B. All Occupancy Sensors:
   1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
   2. Sensor Technology:
      a. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.
   3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
   4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.
   5. Dual Technology Occupancy Sensors: Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
   6. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.
   7. Sensitivity: Field adjustable.
   8. Adaptive Technology: Field selectable; capable of self-adjusting sensitivity and time delay according to conditions.
   9. Compatibility (Non-Dimming Sensors): Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.

10. Load Rating for Line Voltage Occupancy Sensors: As required to control the load indicated on drawings.
11. Isolated Relay for Low Voltage Occupancy Sensors: SPDT dry contacts, ratings as required for interface with system indicated.

C. Wall Switch Occupancy Sensors:
   1. All Wall Switch Occupancy Sensors:
      a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
      b. Unless otherwise indicated or required to control the load indicated on drawings, provide line voltage units with self-contained relay.
      c. Where indicated, provide two-circuit units for control of two separate lighting loads, with separate manual controls and separately programmable operation for each load.
      d. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).
      e. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
   2. Passive Infrared/Ultrasonic Dual Technology Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet (83.6 sq m).

D. Wall Dimmer Occupancy Sensors:
   1. General Requirements:
      a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated dimming control capability , and no leakage current to load in off mode.
      b. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).
      c. Manual-Off Override Control Capability: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
      d. Dimmer: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, and listed as complying with UL 1472; type and rating suitable for load controlled.
      e. Provide field adjustable dimming preset for occupied state.

E. Ceiling Mounted Occupancy Sensors:
   1. All Ceiling Mounted Occupancy Sensors:
      a. Description: Low profile occupancy sensors designed for ceiling installation.
      b. Unless otherwise indicated or required to control the load indicated on drawings, provide low voltage units, for use with separate compatible accessory power packs.
      c. Provide field selectable setting for disabling LED motion detector visual indicator.
      d. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.
      e. Finish: White unless otherwise indicated.
   2. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:
      a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet (41.8 sqm) at a mounting height of 9 feet (2.7 m), with a field of view of 360 degrees.
      b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet (111.5 sqm) at a mounting height of 9 feet (2.7 m), with a field of view of 360 degrees.

F. Power Packs for Low Voltage Occupancy Sensors:
   1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage occupancy sensors for switching of line voltage loads.
   2. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.
   3. Input Supply Voltage: Dual rated for 120/277 V ac.
   4. Load Rating: As required to control the load indicated on drawings.

2.3 OUTDOOR PHOTO CONTROLS

A. Manufacturers:
   1. Intermatic, Inc: www.intermatic.com/#sle.
   2. Tork, a division of NSI Industries LLC: www.tork.com/#sle.

B. Button Type Outdoor Photo Controls

1. Description: Direct-wired photo control unit complying with ANSI C136.24 with weatherproof gasketed wall plate where required or indicated, listed and labeled as complying with UL 773A.
2. Housing: Weather resistant polycarbonate.
3. Photo Sensor: Cadmium sulfide.
4. Light Level Activation: 1 to 3 foot candles (10.8 to 32.3 lux) turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.
5. Voltage: As required to control the load indicated on the drawings.
6. Failure Mode: Fails to the on position.
7. Load Rating: As required to control the load indicated on the drawings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.

F. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.

G. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of lighting control devices provided under this section.
   1. Mounting Heights: Unless otherwise indicated, as follows:
      a. Wall Switch Occupancy Sensors: 48 inches (1.2 m) above finished floor.
   2. Orient outlet boxes for vertical installation of lighting control devices unless otherwise indicated.
   3. Locate wall switch occupancy sensors on strike side of door with edge of wall plate 3 inches (80 mm) from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.

C. Install lighting control devices in accordance with manufacturer's instructions.

D. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

E. Install lighting control devices plumb and level, and held securely in place.

F. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 26 2726.

G. Provide required supports in accordance with Section 26 0529.

H. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

I. Identify lighting control devices in accordance with Section 26 0553.

J. Occupancy Sensor Locations:
   1. Location Adjustments: Do not make adjustments to locations without obtaining approval from the Architect.
   2. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors a minimum of 4 feet (1.2 m) from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.

K. Outdoor Photo Control Locations:
   1. Where possible, locate outdoor photo controls with photo sensor facing north. If north facing photo sensor is not possible, install with photo sensor facing east, west, or down.
   2. Locate outdoor photo controls so that photo sensors do not face artificial light sources, including light sources controlled by the photo control itself.

L. Install outdoor photo controls so that connections are weatherproof. Do not install photo controls with conduit stem facing up in order to prevent infiltration of water into the photo control.

3.4 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect each lighting control device for damage and defects.

C. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.

D. Test outdoor photo controls to verify proper operation, including time delays where applicable.

E. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.5 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect.

C. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.

D. Adjust external sliding shields on outdoor photo controls under optimum lighting conditions to achieve desired turn-on and turn-off activation as indicated or as directed by Architect.

3.6 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.7 COMMISSIONING

A. See Section 01 9113 - General Commissioning Requirements for commissioning requirements.

3.8 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of lighting control devices to Architect, and correct deficiencies or make adjustments as directed.

D. Training: Train Owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.
   3. Instructor: Qualified contractor familiar with the project and with sufficient knowledge of the installed lighting control devices.
   4. Location: At project site.

END OF SECTION

SECTION 26 2200 - LOW VOLTAGE TRANSFORMERS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes dry-type transformers rated 600 V and less.

1.3 SUBMITTALS

A. Product Data: Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   1. Wiring Diagrams: Power wiring.

C. Source quality-control test reports.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For transformers to include in operation and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each transformer type through one source from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

1.5 COORDINATION

A. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Square D; Schneider Electric.
   2. GE Electrical Distribution & Control.
   3. Eaton Electrical Inc; Cutler-Hammer
   4. Siemens Energy & Automation.

2.2 GENERAL TRANSFORMER REQUIREMENTS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B. Cores: Grain-oriented, non-aging silicon steel.

C. Coils: Continuous windings without splices except for taps.
   1. Internal Coil Connections: Brazed or pressure type.
   2. Coil Material: Copper.

2.3 DISTRIBUTION TRANSFORMERS

A. Comply with NEMA ST 20, and list and label as complying with UL 1561.

B. Cores: One leg per phase.

C. Enclosure: Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
   1. Indoor, dry location: NEMA 2, drip-proof.
   2. Indoor, damp location: NEMA 3R.
   3. Outdoor: NEMA 3R.

D. Transformer Enclosure Finish: Comply with NEMA 250.
   1. Finish Color: ANSI 61 gray.

E. Transformer taps: Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity.

F. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 115 deg C rise above 40 deg C ambient temperature.

G. Energy Efficiency for Transformers Rated 15 kVA and Larger:
   1. Complying with Dept. of Energy TP1 efficiency levels.
   2. Tested according to NEMA TP 2.

H. Wall Brackets: Manufacturer's standard brackets.

2.4 SOURCE QUALITY CONTROL

A. Test and inspect transformers according to IEEE C57.12.91.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.

B. Install floor mounted transformers on 4" high concrete housekeeping pad. Pad shall extend 2" past horizontal dimensions.

3.3 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 IDENTIFICATION DEVICES

A. Refer to Division 26 Section "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:
   1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

C. Remove and replace units that do not pass tests or inspections and retest as specified above.

3.6 ADJUSTING

A. Output Settings Report: Prepare a written report recording output voltages and tap settings.

3.7 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION

SECTION 26 2416 - PANELBOARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Lighting and appliance panelboards.

B. Overcurrent protective devices for panelboards.

1.2 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 4300 - Surge Protective Devices.

1.3 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e (Amended 2017).

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

C. NECA 407 - Standard for Installing and Maintaining Panelboards; 2015.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2018.

E. NEMA PB 1 - Panelboards; 2011.

F. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; 2013.

G. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2017.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

K. UL 67 - Panelboards; Current Edition, Including All Revisions.

L. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

M. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

N. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
   1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.

C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   1. Include dimensioned plan and elevation views of panelboards and adjacent equipment with all required clearances indicated.
   2. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
   3. Include documentation of listed series ratings upon request.
   4. Identify mounting conditions required for equipment seismic qualification.

D. Manufacturer's equipment seismic qualification certification.

E. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 1 as routine tests.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Panelboard Keys: Two of each different key.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

A. Maintain ambient temperature within the following limits during and after installation of panelboards:
   1. Panelboards Containing Circuit Breakers: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. ABB/GE Industries: www.geindustrial.com/#sle.

B. Eaton Corporation: www.eaton.com/#sle.

C. Schneider Electric; Square D Products; _____: www.schneider-electric.us/#sle.

D. Siemens Industry, Inc; _____: www.usa.siemens.com/#sle.

2.2 PANELBOARDS - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet (2,000 m).
   2. Ambient Temperature:
      a. Panelboards Containing Circuit Breakers: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).

C. Short Circuit Current Rating:
   1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

D. Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

E. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

F. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

G. Bussing: Sized in accordance with UL 67 temperature rise requirements.
   1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
   2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.

H. Conductor Terminations: Suitable for use with the conductors to be installed.

I. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.
   2. Boxes: Galvanized steel unless otherwise indicated.
      a. Provide wiring gutters sized to accommodate the conductors to be installed.
      b. Provide removable end walls for NEMA Type 1 enclosures.
      c. Provide painted steel boxes for surface-mounted panelboards where indicated, finish to match fronts.
   3. Fronts:
      a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
      b. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
   4. Lockable Doors: All locks keyed alike unless otherwise indicated.

J. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

K. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 26 4300, list and label panelboards as a complete assembly including surge protective device.

L. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
   1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.

2.3 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
   1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
   1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
   2. Phase and Neutral Bus Material: Aluminum.
   3. Ground Bus Material: Aluminum.

D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.

E. Enclosures:
   1. Provide surface-mounted enclosures as indicated.
   2. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
   3. Provide clear plastic circuit directory holder mounted on inside of door.

2.4 OVERCURRENT PROTECTIVE DEVICES

A. Molded Case Circuit Breakers:
   1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
   2. Interrupting Capacity:

a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
b. 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
c. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.

3. Conductor Terminations:
   a. Provide mechanical lugs unless otherwise indicated.
   b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
   a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
5. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
6. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
7. Provide the following features and accessories where indicated or where required to complete installation:
   a. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.

2.5 SOURCE QUALITY CONTROL

A. Factory test panelboards according to NEMA PB 1.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive panelboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.

D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

E. Provide required support and attachment in accordance with Section 26 0529.

F. Install panelboards plumb.

G. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches (2000 mm) above the floor or working platform.

H. Provide grounding and bonding in accordance with Section 26 0526.
   1. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on isolated/insulated ground bus.

I. Install all field-installed branch devices, components, and accessories.

J. Set field-adjustable circuit breaker tripping function settings as indicated.

K. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

L. Provide filler plates to cover unused spaces in panelboards.

M. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
   1. Emergency and night lighting circuits.
   2. Fire detection and alarm circuits.
   3. Communications equipment circuits.
   4. Intrusion detection and access control system circuits.
   5. Video surveillance system circuits.

N. Identify panelboards in accordance with Section 26 0553.

3.3 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than 100 amperes. Tests listed as optional are not required.
   1. Perform insulation-resistance tests on all control wiring with respect to ground.
   2. Test functions of the trip unit by means of secondary injection.

D. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.

E. Test GFCI circuit breakers to verify proper operation.

F. Test shunt trips to verify proper operation.

G. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.

H. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of panelboard fronts.

C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

3.5 CLEANING

A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 2726 - WIRING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wall switches.

B. Wall dimmers.

C. Fan speed controllers.

D. Receptacles.

E. Wall plates.

1.2 RELATED REQUIREMENTS

A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Manufactured wiring systems for use with access floor boxes with compatible pre-wired connectors.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

C. Section 26 0533.16 - Boxes for Electrical Systems.

D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 0923 - Lighting Control Devices: Devices for automatic control of lighting, including occupancy sensors, in-wall time switches, and in-wall interval timers.

F. Section 27 1000 - Structured Cabling: Voice and data jacks.

1.3 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for; 2017h.

B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification); 2017g.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.

E. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2015).

F. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2016.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.

I. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.

J. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

K. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.

L. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

M. UL 1917 - Solid-State Fan Speed Controls; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
   2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
   3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
   4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
   5. Coordinate the core drilling of holes for poke-through assemblies with the work covered under other sections.
   6. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Sequencing:
   1. Do not install wiring devices until final surface finishes and painting are complete.

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Certificates for Surge Protection Receptacles: Manufacturer's documentation of listing for compliance with UL 1449.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Operation and Maintenance Data:
   1. Wall Dimmers: Include information on operation and setting of presets.
   2. GFCI Receptacles: Include information on status indicators.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 PRODUCTS

2.1 WIRING DEVICE APPLICATIONS

A. Provide wiring devices suitable for intended use and with ratings adequate for load served.

B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.

C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.

D. Provide GFCI protection for receptacles installed within 6 feet (1.8 m) of sinks.

E. Provide GFCI protection for receptacles installed in kitchens.

F. Provide GFCI protection for receptacles serving electric drinking fountains.

G. Provide isolated ground receptacles for receptacles serving computers and electronic cash registers.

2.2 WIRING DEVICE FINISHES

A. Provide wiring device finishes as described below unless otherwise indicated.

B. Wiring Devices, Unless Otherwise Indicated: Brown with wall plate, approved by Architect.

2.3 WALL SWITCHES

A. Manufacturers:
   1. Hubbell Incorporated: www.hubbell.com/#sle.
   2. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
   3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.

B. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.4 WALL DIMMERS

A. Manufacturers:
   1. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
   2. Lutron Electronics Company, Inc; Maestro Series: www.lutron.com/#sle.
   3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.

B. Wall Dimmers - General Requirements: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.

C. Control: Slide control type with separate on/off switch.

D. Power Rating, Unless Otherwise Indicated or Required to Control the Load Indicated on the Drawings:
   1. Magnetic Low-Voltage: 600 VA.
   2. Electronic Low-Voltage: 400 VA.

E. Provide locator light, illuminated with load off.

2.5 FAN SPEED CONTROLLERS

A. Manufacturers:
   1. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
   2. Lutron Electronics Company, Inc; Maestro Series: www.lutron.com/#sle.
   3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.

B. Description: 120 V AC, solid-state, full-range variable speed, rotary control type with rotary on/off control, with integral radio frequency interference filtering, fan noise elimination circuitry, power failure preset memory, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1917.
   1. Current Rating: 1.5 A unless otherwise indicated or required to control the load indicated on the drawings.

2.6 RECEPTACLES

A. Manufacturers:
   1. Hubbell Incorporated: www.hubbell.com/#sle.
   2. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
   3. Lutron Electronics Company, Inc; Designer Style: www.lutron.com/#sle.
   4. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.

B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring with separate ground terminal screw.
   2. NEMA configurations specified are according to NEMA WD 6.

C. Convenience Receptacles:
   1. Standard Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
   2. Weather Resistant Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.

D. GFCI Receptacles:
   1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
   2. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.

E. USB Charging Devices:
   1. USB Charging/Tamper Resistant Receptacle Combination Devices: Two-port (Type A) USB charging device and receptacle, commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; rectangular decorator style.

F. Locking Receptacles: Industrial specification grade, configuration as indicated on the drawings.

2.7 WALL PLATES

A. Manufacturers:
   1. Hubbell Incorporated: www.hubbell-wiring.com/#sle.
   2. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
   3. Lutron Electronics Company, Inc: www.lutron.com/#sle.
   4. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.

B. Wall Plates: Comply with UL 514D.
   1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
   2. Size: Standard.
   3. Screws: Metal with slotted heads finished to match wall plate finish.

C. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.

D. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

E. Weatherproof Covers for Damp Locations: Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.

F. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

F. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of wiring devices provided under this section.
   1. Mounting Heights: Unless otherwise indicated, as follows:
      a. Wall Switches: 48 inches (1200 mm) above finished floor.
      b. Wall Dimmers: 48 inches (1200 mm) above finished floor.
      c. Fan Speed Controllers: 48 inches (1200 mm) above finished floor.
      d. Receptacles: 18 inches (450 mm) above finished floor or 6 inches (150 mm) above counter.
   2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
   3. Locate wall switches on strike side of door with edge of wall plate 3 inches (80 mm) from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
   4. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches (150 mm) long. Do not connect more than one conductor to wiring device terminals.

F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

H. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

I. Install wiring devices plumb and level with mounting yoke held rigidly in place.

J. Install wall switches with OFF position down.

K. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

L. Do not share neutral conductor on branch circuits utilizing wall dimmers.

M. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

N. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

O. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

P. Identify wiring devices in accordance with Section 26 0553.

3.3 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect each wiring device for damage and defects.

C. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.

D. Test each receptacle to verify operation and proper polarity.

E. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

F. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.4 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust presets for wall dimmers according to manufacturer's instructions as directed by Architect.

3.5 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

SECTION 26 2813 - FUSES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fuses.

1.2 RELATED REQUIREMENTS

A. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

B. Section 26 2416 - Panelboards: Fusible switches.

C. Section 26 2816.16 - Enclosed Switches: Fusible switches.

D. Section 26 2913 - Enclosed Controllers: Fusible switches.

1.3 REFERENCE STANDARDS

A. NEMA FU 1 - Low Voltage Cartridge Fuses; 2012.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements; Current Edition, Including All Revisions.

D. UL 248-4 - Low-Voltage Fuses - Part 4: Class CC Fuses; Current Edition, Including All Revisions.

E. UL 248-8 - Low-Voltage Fuses - Part 8: Class J Fuses; Current Edition, Including All Revisions.

F. UL 248-10 - Low-Voltage Fuses - Part 10: Class L Fuses; Current Edition, Including All Revisions.

G. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses; Current Edition, Including All Revisions.

H. UL 248-15 - Low-Voltage Fuses - Part 15: Class T Fuses; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
      a. Fusible Enclosed Switches: See Section 26 2816.16.
      b. Fusible Switches for Enclosed Motor Controllers: See Section 26 2913.
   2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Fuses: One set(s) of three for each type and size installed.
   3. Fuse Pullers: One set(s) compatible with each type and size installed.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Bussmann, a division of Eaton Corporation: www.cooperindustries.com/#sle.

B. Little fuse, Inc: www.littelfuse.com/#sle.

C. Mersen: ep-us.mersen.com/#sle.

2.2 APPLICATIONS

A. Service Entrance:
   1. Fusible Switches up to 600 Amperes: Class RK1, fast-acting, non-time-delay.

B. Feeders:
   1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.

C. General Purpose Branch Circuits: Class J, time-delay.

D. Individual Motor Branch Circuits: Class J, time-delay.

2.3 FUSES

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.

C. Provide fuses of the same type, rating, and manufacturer within the same switch.

D. Comply with UL 248-1.

E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.

F. Voltage Rating: Suitable for circuit voltage.

G. Class R Fuses: Comply with UL 248-12.
   1. Class RK1, Fast-Acting, Non-Time-Delay Fuses:

H. Class J Fuses: Comply with UL 248-8.
   1. Class J, Time-Delay Fuses:

I. Class CC Fuses: Comply with UL 248-4.
   1. Class CC, Time-Delay Fuses:

J. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

K. Provide the following accessories where indicated or where required to complete installation:
   1. Fuse holders: Compatible with indicated fuses.
   2. Fuse Reducers: For adapting indicated fuses to permit installation in switch designed for fuses with larger ampere ratings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.

B. Verify that mounting surfaces are ready to receive spare fuse cabinet.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Do not install fuses until circuits are ready to be energized.

B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

END OF SECTION

SECTION 26 2816.16 - ENCLOSED SWITCHES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Enclosed safety switches.

1.2 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2018.

C. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

F. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

G. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

H. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   1. Include dimensioned plan and elevation views of enclosed switches and adjacent equipment with all required clearances indicated.
   2. Include wiring diagrams showing all factory and field connections.

C. Manufacturer's equipment seismic qualification certification.

D. Field Quality Control Test Reports.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

F. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

A. Maintain ambient temperature between -22 degrees F (-30 degrees C) and 104 degrees F (40 degrees C) during and after installation of enclosed switches.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. ABB/GE Industries: www.geindustrial.com/#sle.

B. Eaton Corporation: www.eaton.com/#sle.

C. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.

D. Siemens Industry, Inc: www.usa.siemens.com/#sle.

2.2 ENCLOSED SAFETY SWITCHES

A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet (2,000 m).
   2. Ambient Temperature: Between -22 degrees F (-30 degrees C) and 104 degrees F (40 degrees C).

D. Horsepower Rating: Suitable for connected load.

E. Voltage Rating: Suitable for circuit voltage.

F. Short Circuit Current Rating:
   1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
   2. Minimum Ratings:
      a. Switches Protected by Class H Fuses: 10,000 rms symmetrical amperes.
      b. Heavy Duty Single Throw Switches Protected by Class R, Class J, Class L, or Class T Fuses: 200,000 rms symmetrical amperes.

G. Enclosed Safety Switches Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

H. Provide with switch blade contact position that is visible when the cover is open.

I. Fuse Clips for Fusible Switches: As required to accept fuses indicated.
   1. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.

J. Conductor Terminations: Suitable for use with the conductors to be installed.

K. Provide insulated, ground able fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.

L. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

M. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.
      b. Outdoor Locations: Type 3R.

2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.

N. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

O. Heavy Duty Switches:
   1. Comply with NEMA KS 1.
   2. Conductor Terminations:
      a. Provide mechanical lugs unless otherwise indicated.
      b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed safety switches.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section 26 0529.

E. Install enclosed switches plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches (2000 mm) above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 26 0526.

H. Provide fuses complying with Section 26 2813 for fusible switches as indicated or as required by equipment manufacturer's recommendations.

I. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

J. Identify enclosed switches in accordance with Section 26 0553.

3.3 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

D. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.5 CLEANING

A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 5100 - INTERIOR LIGHTING

PART 2 PRODUCTS

1.1 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

1.2 LUMINAIRES

A. Manufacturers:
   1. Acuity Brands, Inc: www.acuitybrands.com/#sle.
   2. Cooper Lighting, a division of Cooper Industries: www.cooperindustries.com/#sle.
   3. Hubbell Lighting, Inc: www.hubbelllighting.com/#sle.
   4. Lutron Electronics Company, Inc; www.lutron.com/#sle.
   5. Philips Lighting North America Corporation; www.lightingproducts.philips.com/#sle.

B. Provide products that comply with requirements of NFPA 70.

C. Provide products that are listed and labeled as complying with UL 1598, where applicable.

D. Provide products listed, classified, and labeled as suitable for the purpose intended.

E. Provide products complying with Federal Energy Management Program (FEMP) requirements.

F. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

G. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

H. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

I. Recessed Luminaires:
   1. Ceiling Compatibility: Comply with NEMA LE 4.
   2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.

J. LED Luminaires:
   1. Components: UL 8750 recognized or listed as applicable.
   2. Tested in accordance with IES LM-79 and IES LM-80.
   3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

K. LED Tape Lighting Systems: Provide all power supplies, drivers, cables, connectors, channels, covers, mounting accessories, and interfaces as necessary to complete installation.
   1. LED Tape - General Requirements:
      a. Listed.
      b. Designed for field cutting in accordance with listing.
   2. White LED Tape:
      a. Correlated Color Temperature (CCT): _____ K unless otherwise indicated.
      b. Color Rendering Index (CRI): Not less than 90.

L. Track Lighting Systems: Provide track compatible with specified track heads, with all connectors, power feed fittings, dead ends, hangers and canopies as necessary to complete installation.

M. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

1.3 EMERGENCY LIGHTING UNITS

A. Manufacturers:
   1. Acuity Brands, Inc: www.acuitybrands.com/#sle.
   2. Cooper Lighting, a division of Cooper Industries: www.cooperindustries.com/#sle.
   3. Hubbell Lighting, Inc: www.hubbelllighting.com/#sle.

B. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

C. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for

minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

D. Battery:
   1. Sealed maintenance-free lead calcium unless otherwise indicated.
   2. Size battery to supply all connected lamps, including emergency remote heads where indicated.

E. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.

F. Provide low-voltage disconnect to prevent battery damage from deep discharge.

G. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.

H. Where indicated, provide units with integral time delay to maintain emergency illumination for 15 minutes after restoration of normal power source.

I. Accessories:
   1. Provide compatible accessory mounting brackets where indicated or required to complete installation.
   2. Where indicated, provide emergency remote heads that are compatible with the emergency lighting unit they are connected to and suitable for the installed location.

1.4 EXIT SIGNS

A. Manufacturers - Powered and Self-Luminous Signs:
   1. Acuity Brands, Inc: www.acuitybrands.com/#sle.
   2. Cooper Lighting, a division of Cooper Industries: www.cooperindustries.com/#sle.
   3. Hubbell Lighting, Inc: www.hubbelllighting.com/#sle.
   4. Philips Lighting North America Corporation; www.lightingproducts.philips.com/#sle.

B. Description: Internally illuminated exit signs with LEDs unless otherwise indicated; complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
   1. Number of Faces: Single or double as indicated or as required for the installed location.
   2. Directional Arrows: As indicated or as required for the installed location.

C. Self-Powered Exit Signs:
   1. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
   2. Battery: Sealed maintenance-free lead calcium unless otherwise indicated.
   3. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
   4. Provide low-voltage disconnect to prevent battery damage from deep discharge.
   5. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.

D. Accessories:
   1. Provide compatible accessory high impact polycarbonate vandal shields where indicated.
   2. Provide compatible accessory wire guards where indicated.

1.5 BALLASTS AND DRIVERS

A. Manufacturers:
   1. General Electric Company/GE Lighting: www.gelighting.com/#sle.
   2. Lutron Electronics Company, Inc; www.lutron.com/#sle.
   3. OSRAM Sylvania, Inc: www.osram.us/ds/#sle.
   4. Philips Lighting North America Corporation; www.usa.lighting.philips.com/#sle.
   5. Where a specific manufacturer or model is indicated elsewhere in the luminaire schedule or on the drawings, substitutions are not permitted unless explicitly indicated.

B. Ballasts/Drivers - General Requirements:
   1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
   2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.

C. Dimmable LED Drivers:
   1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
   2. Control Compatibility: Fully compatible with the dimming controls to be installed.

a. Wall Dimmers: See Section 26 2726.
b. Daylighting Controls: See Section 26 0923.

3. Product(s):
   a. Lutron Hi-Lumen Premier 0.1% Constant Voltage (L3D0-Series): 3-wire and digital control; 0.1 percent dimming with Soft-On and Fade-to-Black low end performance; www.lutron.com/#sle.

1.6 ACCESSORIES

A. Provide accessory plaster frames for luminaires recessed in plaster ceilings.

PART 3 EXECUTION

2.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

2.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

2.3 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of luminaires provided under this section.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer's instructions.

D. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).

E. Provide required support and attachment in accordance with Section 26 0529.

F. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

G. Suspended Ceiling Mounted Luminaires:
   1. Do not use ceiling tiles to bear weight of luminaires.
   2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
   3. Secure surface-mounted and recessed luminaires to ceiling support channels or framing members or to building structure.
   4. Secure pendant-mounted luminaires to building structure.
   5. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
   6. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gage, connected from opposing corners of each recessed luminaire to building structure.
   7. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.

H. Recessed Luminaires:
   1. Install trims tight to mounting surface with no visible light leakage.
   2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
   3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.

I. Install accessories furnished with each luminaire.

J. Bond products and metal accessories to branch circuit equipment grounding conductor.

K. Emergency Lighting Units:
   1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
   2. Install lock-on device on branch circuit breaker serving units.

L. Exit Signs:

1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
2. Install lock-on device on branch circuit breaker serving units.

M. Install lamps in each luminaire.

N. Lamp Burn-In: Operate lamps at full output for prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

2.4 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Test self-powered exit signs and emergency lighting units to verify proper operation upon loss of normal power supply.

E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

2.5 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect or authority having jurisdiction.

C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

2.6 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

2.7 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

D. Just prior to Substantial Completion, replace all lamps that have failed.

2.8 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

SECTION 28 3111 - FIRE ALARM AND DETECTION SYSTEM

DESIGN AND INSTLLATION

1.1 THIS DOCUMENT IDENTIFIES THE MINIMUM DESIGN, INSTALLATION, TESTING AND QUALITY LEVELS FOR NEW, RETROFIT AND/OR RENOVATED FIRE ALARM AND DETECTION SYSTEMS BEING SUPPLIED TO ANY FACILITY. THE ARCHITECT/ENGINEER SHALL INCLUDE ALL OF THESE MINIMUM REQUIREMENTS WITHIN THE CONTENT OF THE BIDDING DOCUMENTS AND ENSURE THAT ALL MINIMUM REQUIREMENTS ARE COMPLIED WITH THROUGH COMPLETION OF THE PROJECT.

1.2 DURING THE DESIGN PHASE OF THE PROJECT, THE RESPONSIBLE DESIGN TEAM MEMBER SHALL PREFORM THE FOLLOWING:

1.3 RETROFIT OR RENOVATION PROJECTS:

1.4 CONSULT WITH TO DETERMINE THE EXTENT OF RETROFIT OR RENOVATION.

1.5 ALL RETROFIT WORK SHALL USE ONLY NEW EQUIPMENT AND MATERIALS. NO REUSE OF EQUIPMENT OR MATERIALS IS PERMITTED EXCEPTION FOR SPECIAL EXCEPTION BY THE UNIVERSITY.

1.6 ALL RENOVATION WORK MAY CONNECT OR INTERFACE WITH EXISTING EQUIPMENT THAT IS TO REMAIN IN USE BUT ALL RELOCATED, REPLACEMENT OR NEW DEVICES SHALL MEET THE REQUIREMENTS OF THIS SPECIFICATION FOR NEW EQUIPMENT.

1.7 SURVEY EXISTING SYSTEM AND DEVELOP DEMOLITION DRAWINGS OF THE EXISTING SYSTEM.

1.8 DEVELOP NEW SYSTEM AND DEVICE DRAWINGS FOR RETROFIT OR RENOVATION.

1.9 IF BUILDING IS OCCUPIED DURING THE RETROFIT/RENOVATION, THE EXISTING FIRE ALARM SHALL BE MAINTAINED OPERATIONAL DURING INSTALLATION AND ACCEPTANCE OF THE NEW SYSTEM.

1.10 THE PROJECT SHALL INCLUDE SMOKE DETECTOR BAFFLES (SEE APPENDIX A-1 FOR DETAIL) FOR EACH SMOKE DETECTOR THAT IS LOCATED WITHIN 6 FEET OF A SUPPLY OR RETURN AIR GRILL.

1.11 ALL WIRE LABELS, WIRE SHIELD DRAIN WIRES AND BACK BOXES SHALL CONFORM TO THIS SPECIFICATIONS FOR NEW WORK (SEE APPENDIX A-2).

1.12 ALL FIRE ALARM CONTROL PANELS AND ASSOCIATED REQUIRED CONTAINERS SHALL BE CONFIGURED AS PER THESE SPECIFICATIONS FOR NEW WORK (SEE APPENDIX A-3).

1.13 NEW CONSTRUCTION PROJECTS:

1.14 CONSULT WITH TO DETERMINE THE DESIGN OF THE FIRE ALARM SYSTEM THAT MAY REQUIRE ALARM/DETECTION REQUIREMENTS BEYOND THE MINIMUM CODE REQUIREMENTS.

1.15 DESIGN TEAM TO IDENTIFY THE CORRECT OCCUPANCY CLASSIFICATION(S) AND DETERMINE MINIMUM REQUIRED CODE COMPLIANCE, I.E. LEVEL OF DETECTION, TYPE OF DETECTION, TYPE OF INDICATING ALARM, ETC.

1.16 ALL FIRE ALARM PROJECTS:

1.17 ROWAN UNIVERSITY FIRE ALARM PROJECTS SHALL BE STANDARD AUDIO VISUAL FIRE ALARM SYSTEMS (UNLESS OTHERWISE REQUIRED BY CODE TO BE VOICE EVAC).

1.18 IN ADDITION TO ALL CODE REQUIRED DETECTION BASED UPON OCCUPANCY CLASSIFICATION, EACH PROJECT SHALL INCLUDE SELECTED ARE SMOKE DETECTION AS FOLLOWS:

A. Smoke detection in all primary corridors

B. Smoke detection in all mechanical equipment rooms

C. Smoke detection in all electronic/IT rooms
D. Smoke detection in all storage rooms
E. Top of exit stairs
F. Top of mechanical shafts

1.19 CARBON MONOXIDE DETECTION SHALL BE PROVIDED AS FOLLOWS:

A. In the vicinity of any internal combustion engine
B. On each floor using a flame generated fuel source for heat or appliances

1.20 ALL SPRINKLER AND FIRE PUMP VALVES SHALL BE PROVIDED WITH VALVE SUPERVISION

PART 1 GENERAL

THE INTENT OF THE SYSTEM SHALL MEET THE MINIMUM CODE REQUIREMENTS AS SPECIFIED, BUT IN ADDITION, SHALL MEET THE SPECIFIC LEVEL OF LIFE SAFETY AND PROTECTION AS REQUIRED BY ROWAN UNIVERSITY IN THESE MINIMUM REQUIREMENTS. IN ALMOST ALL CASES, THESE MINIMUM REQUIREMENTS WILL REQUIRE A HIGHER DEGREE OF PROTECTION AND WORKMANSHIP THAN THAT SPECIFIED BY THE REFERENCED CODES.

THE SYSTEM SHALL BE DESIGNED IN A MODULAR FASHION TO INSURE FUTURE EXPANSION CAPABILITY. FURTHERMORE, IT SHALL BE THE INTENT OF THE SYSTEM TO MONITOR ALL FIRE SUPPRESSION SYSTEMS, FIRE EXTINGUISHING SYSTEMS AND BUILDING SERVICES AS DESIGNATED. THE FIRE ALARM AND DETECTION SYSTEM IS THE CENTERPIECE OF THE ROWAN UNIVERSITY'S LIFE SAFETY SYSTEMS AND IS INTENDED TO PROVIDE A HIGH DEGREE OF ALARM NOTIFICATION, DETECTION CRITICAL SYSTEM MONITORING AND SELECTED CONTROL OUTPUTS. CURRENTLY, THIS DESIGN IS INTENDED TO PROVIDE THE ROWAN UNIVERSITY WITH A HIGH DEGREE OF RELIABILITY AND NO UNWANTED ALARMS.

IN LARGE AND INTRICATE FACILITIES THE UNIVERSITY WOULD PREFER TO HAVE A SINGLE POINT ADDRESSABLE SYSTEM. IN SMALLER LESS INTRICATE FACILITIES THE UNIVERSITY WILL CONSIDER A STANDARD ZONED FIRE ALARM AND DETECTION SYSTEM, HOWEVER; THE SINGLE POINT ADDRESSABLE SYSTEM IS PREFERRED. THE DESIGNER OF THE SYSTEM SHALL CONSULT WITH DESIGN AND CONSTRUCTION TO IDENTIFY THE SPECIFIC TYPE OF SYSTEM BEING PROPOSED. TYPES OF SIGNALING SYSTEMS AND METHOD OF OCCUPANT NOTIFICATION WILL BE DETERMINED AT THE TIME OF CONSULTATION WITH DESIGN AND CONSTRUCTION.

THE DESIGN, INSTALLATION, WORKMANSHIP, TESTING AND DOCUMENTATION OF THE SYSTEM MUST BE OF THE HIGHEST QUALITY. DESIGN AND CONSTRUCTION SHALL BE THE FINAL JUDGE OF QUALITY ISSUES AND THEIR DECISION IS FINAL. IF BIDDERS OR ANY INTERESTED PARTIES HAVE A CONCERN WITH THESE CONDITIONS, THEY SHALL NOTE THEIR CONCERNS IN WRITING AT THE TIME OF PRE-BID MEETINGS AND AT THE TIME OF BID SUBMISSION.

6.1 THE FIRE ALARM SYSTEM SHALL BE A STAND-ALONE FIRE ALARM SYSTEM WITH CENTRAL STATION MONITORING.

A. The fire alarm system shall be complete in all respects for operation and interface with building equipment related to or desired to be controlled by the fire alarm system. All work shall be coordinated with the Rowan University's Design and Construction. The fire alarm contractor/designer shall include in his/her design all work necessary to interface Heating, Ventilation and Air Conditioning shut-down, sprinkler monitoring and control, building systems monitoring, smoke management and other code specified supervisory functions. Any equipment, wiring, installation or other work necessary to finish all interface and output wiring or equipment shall be included in the design and subsequent bid packages and meet these minimum specifications.
   1. Prior to the start of any design or installation, the Contractor and Vendor shall have a "kick off" meeting with Design and Construction to include the following in attendance:
      a. Contractor's actual wire and device installer(s) for the project. This is the actual mechanic(s) that will be performing the work.
         1 Actual Vendor tech that will be doing all end point connections and testing.

a Actual Vendor designer and NICET Level IV holder.
(1) University Representative of their choice

2. Definitions
   a. ASME: American Society of Mechanical Engineers
      1 FACP: Fire alarm control panel.
         a FM: FM Global (Factory Mutual).
         b NFPA: National Fire Protection Association. Definitions in NFPA 72 apply to fire alarm terms used in this Section.
         c NICET: National Institute for Certification in Engineering Technologies.
         d UL: Underwriters Laboratories.
3. References/Required Code Compliance – (Most current editions)
4. NFPA 72 – National Fire Alarm Code, Currently Adopted Edition by the State of New Jersey.
5. NFPA 25 – Inspection, Testing and Maintenance of Water-based Fire Protection Systems, Currently Adopted Edition by the State of New Jersey.
6. NFPA 101 - Life Safety Code, most current edition.
   a. International Building Code, Currently Adopted Edition by the State of New Jersey.
7. International Fire Code, Currently Adopted Edition by the State of New Jersey.
8. Underwriters' Laboratories fire alarm and fire alarm equipment listings, approvals and standards.
9. Factory Mutual fire alarm approvals and standards.
   a. NFPA 70 - National Electric Code, Currently Adopted Edition by the State of New Jersey.
   b. Americans with Disabilities Act, (except as modified per these specifications).
10. NFPA 90A – Installation of Air Condition and Ventilating Systems.
11. Requirements of Regulatory Agencies
12. All equipment, components, wiring, design and the installation of all items as described or implied in this document shall meet all of the appropriate requirements in the codes, standards and guidelines as listed.
13. All equipment, components, wiring, design and installation of all items as described or implied in this document shall be UL listed and approved for the use intended.
    a. All equipment, components, wiring, design and installation of all items as described or implied in this document shall be reviewed and approved by all required code authorities. The Contractor shall be responsible to submit all design documents and obtain all approvals from each listed code authority only after the submissions have been reviewed and approved by Rowan University. No submission will be made to a code official until Rowan University r has approved the shop drawings.
14. The Contractor shall be responsible for all submission costs and the Contractor shall be responsible for obtaining all required approvals, permits, and acceptance inspections/approvals from all legal and/or required agencies, inspection organizations and insurance groups as listed in these specifications.
15. Coordination
16. The Contractor shall fully coordinate the design, equipment, devices, installation, wiring and connection of all fire alarm systems with the Owner and/or their authorized representative and all other related contractors throughout each developmental stage of the project.
17. Fully coordinate the installation of all systems with other contractors and other work in progress or proposed progress at the time of Contractors design and installation. It shall be the Contractor's responsibility to communicate with Rowan University on-site representatives and identify all other work or trades which will require coordination with the fire alarm system design and installation.
18. The Contractor shall include in his schedule key times to notify the University Liaison Representative for periodic inspection of the system installation. The University requires an inspection of the installation at the following points of:
    a. Shop drawing development
    b. 25% of rough in wiring installation
    c. Device and panel installation
    d. Final acceptance testing
19. Submittals
20. Submittals at Time of Shop Drawings and Shop Drawing Format
21. All shop drawings shall be approved by Design and Construction. Submit two copies of all shop drawings prior to equipment delivery and installation of wiring.
    a. The contractor shall be responsible to submit all approval drawings, shop drawings, and as-built drawings in a scale no smaller than 1/8 inch scale.

22. All shop drawings shall show proposed wiring diagrams point-to-point with labeled terminal and splice points, data sheets, equipment ratings, layout, dimensions, conduit, wire mold, material type and finishes.
23. Submit material list indicating proposed manufacturer's name and design/installation data for all systems and materials listed, specified or intended for use by the Contractor.
    a. The Contractor shall be required to submit the following series of drawings:
        1 Shop drawings
        2 Panel drawings
        3 Schematics of all auxiliary devices and auxiliary system connections such as HVAC, etc.
            a Contractor shall be responsible to provide all shop, panel, schematic and as-built drawings in a CAD format. Drawings shall be multiple-colored ink on high quality, white bond plotting paper of a standard size sheet as agreed upon with Design and Construction and shall include the following parameters:
                (1) CAD (Computer aided drafting) form using an acceptable CAD system capable of producing the electronic media in an AutoCAD latest version format.
    b. The Rowan University shall own all electronic media and original drawings addressed under this specification. Rowan University shall have the right to modify, reproduce, distribute and use the electronic media and original drawings in any fashion or for any use that Rowan University may desire.
24. The Contractor and manufacturer shall retain a copy of all as-built drawings and documentation as discussed in these specifications. The Contractor and manufacturer shall not have the right to use any digital media, drawings, documentation or other material describing or relating to the fire alarm system without the express written permission of Rowan University.
25. All drawings shall show building background features in "green" ink with single narrow pen width. Panel drawings shall show panel box and chassis in green.
26. All drawings shall show fire alarm and detection features in "black" ink with varying pen widths. Separate pen widths shall demarcate devices, point-to-point wiring, device labels, and notes.
    a. All drawings shall show underfloor fire alarm and detection features in "red" ink with varying pen widths. Separate pen widths shall demarcate devices, point-to-point wiring, devices labels, and notes.
27. All drawings shall show labels, wire sizes and other similar information in "blue" ink.
28. Contractor shall show exposed conduit or surface mounted devices or surface mounted Wiremold in "orange" with a heavy pen width. Contractor may use other colors to demarcate other features of information on the drawings, but such colors shall be consistent from drawing to drawing and legible.
29. Match wiring details, including number of wires per initiating and signal circuit, and location and type of end-of-line device to type of supervision specified.
30. Show locations of fire alarm control panels, NAC panels, surge suppression enclosures and documentation cabinets on drawings to ensure adequate space is available.
31. Ensure drawings and specifications agree with respect to type of cable specified and that cable specified is suitable for the environment of the specific project.
32. Contractor shall produce and provide electrical schematic diagrams of any electrical connections between the fire alarm system and building equipment. These drawings shall be submitted at the time of shop drawings and as-built drawing submission.
    a. As part of this project and included within the base bid cost, the Contractor shall provide Rowan University with "as-built" drawings for the entire fire alarm system showing all features as described in these specifications in their entirety, in an "as-built" status. All changes and/or corrections to the approved shop drawings made during installation and testing shall be documented and shown on the final as-built documents.
33. Along with the as-built drawing submission, the Contractor shall supply three complete sets of AutoCAD files of all drawings including the panel drawings.
    a. The Contractor shall provide one complete set of documentation for onsite use. Rowan University will return one of the three sets of documentation that are required by Part 5, back to the Contractor for installation into the documentation cabinet.
        1 Note: It is the intent of this section to ensure that a complete and adequate set of documentation exists on-site and is available to service technicians, inspectors, and fire department. No documents or other items will be permitted to be stored inside of any fire alarm control equipment or other enclosure.
34. All shop drawing submissions shall include the following:
    a. A narrative description of the fire alarm system. The narrative description shall include an exact English description of all signaling arrangements, detection arrangements, output and supervisory functions.

1 All panel drawings shall show power and battery calculations for the system. Panel drawings shall show all wiring, ribbon and other cable point connections. Show any field or manufacturer modifications to include dip switch set-up positions, jumpers and snipped components including wire color coding and labeling.
   a The system drawings shall have a plan view of each floor and a detailed riser diagram.
      (1) Actual wire, wire mold and conduit runs with anticipated methods of matching backgrounds or concealment of wire and conduit. Conduit and wire mold placement must be approved by the Owner.
      (2) System annunciation descriptors for each alarm, trouble and supervisory output signal. Such descriptors shall be in "plain English" for each alarm, trouble and supervisory output signal. The English annunciation descriptors shall use actual terminology used at the project building to include floor names and point of compass designations un-coded. Contractor shall confirm descriptors with the Owner's on-site representative prior to shop drawing submission.

35. Note: Code numbers, zone numbers or abbreviated text will not be approved without exception.
   a. Submission of coded, zoned or abbreviated text will be rejected at the time of shop drawing submission without cause or comment! If bidder does not understand this requirement, seek clarification from the Owner prior to bid submission. Only complete and understandable English descriptors for fire alarm point and trouble annunciation will be approved.
      1 Contractor shall show all exposed conduit (if any) at the time of shop drawings and received approval of the Owner. All exposed conduit must be clearly annunciated on shop drawings by use of heavy weight pen markings and color.
36. Submit one (1) actual sample of each type of device intended for installation. If devices differ from area to area, then two (2) actual samples of each type of device labeled for the specific area must be submitted. These items include but are not limited to the following:
   a. Manual Pull Stations
      1 Audio Devices
         a Visual Devices
            (1) Smoke Detectors
            (2) Heat Detectors
            (3) Duct Detectors and remote test switch
            (4) Conduit and Pipe
            (5) Wiring
            (6) Junction and Back Boxes
            (7) Din Rail Compression Terminal Blocks
            (8) Weather Proof Enclosures
            (9) Water Tight Junction Boxes
            (10) Mounting Plates
            (11) Addressable Modules (if not in Monitor control panel).
            (12) Detail drawing and sample of each wiring connection to all devices and any proposed splice connections.
            (13) Wire mold and back box (if applicable).
37. Shop drawings shall include original design notes for basis of design.
   a. Submittals at the Time of Acceptance Testing
      1 Prior to acceptance test submit manufacturer's descriptive literature of actual equipment installed and the following:
      2 Equipment installation manual.
         a Equipment and device operating instructions manual.
            (1) Equipment maintenance and programming manuals.
            (2) Equipment/system service and repair data manual.
            (3) Parts lists.
            (4) Spare equipment and parts equipment and inventory list.
            (5) Testing and maintenance schedule as per requirements of these specifications.
38. For testing and documentation submittal requirements, see Testing and Documentation, Part 5 in these specifications.
39. Warranty
40. The successful Bidder/contractor shall be responsible for all warranty and guarantee issues regardless of subcontractors, vendors or others operating as subcontractors under the successful Bidders contract. Bid submission documents shall include a document executed by the successful Bidder's senior corporate or company officer indicating that the successful Bidder understands that he/she is solely

responsible legally and financially to the Owner for compliance to warranty and guarantee issues as follows:

a. All system equipment shall be guaranteed for a period of one year from date of final acceptance of each system in accordance with Part 5 of these specifications.
b. All raceways and wiring are guaranteed to be free from inherent mechanical or electrical defects for one year from the date of final acceptance of the systems in accordance with Part 5 of these specifications.
    1 Regardless of typical manufacturer or Contractor canned warranties and guarantees, the base bid price shall include all fees for warranty or guarantee cost to include parts, labor, shipping, stocking, overhead, markup or other costs associated with performing work under the warranty or guarantee agreement. It is the intent of this section that the entire system will be warranted and guaranteed from any fault (other than an act of God or acts by other than the alarm system Contractor). If anything goes wrong with the system, the Contractor shall repair/correct at no cost to the Owner with components, parts and workmanship that are NEW, not rebuilt or reconditioned parts or equipment. If this intent is not clear or understood by the Bidder, the Bidder shall seek clarification from Owner prior to bid submission.

41. As part of the successful bidder's warranty package, the successful bidder shall submit at the time of system acceptance under Part 5 of the specifications, a schedule of maintenance, testing, and service as prescribed by these specifications and referenced standards, for the first year warranty period, (see NFPA 72 for additional requirements). The cost for the first year maintenance and testing shall be included in the base bid price.
42. All warranty service that impairs the function of the fire alarm system shall be provided within four hours of notification to the Contractor. Cost for this service shall be included within the base bid price.
43. All warranty service that does not impair the function of the fire alarm system but is obligated under the warranty shall be performed within 24 hours of notification to the Contractor unless otherwise approved by the Owner.
44. Warranty starting period shall be based upon the determination of substantial completion as defined by the American Institute of Architects General and Federal Supplementary Conditions of The Contract for
45. Construction, AIA Document A201-1976 and A201/SC-1977. For purposes of this work, Design and Construction shall be known as the "architect" regarding implementation of substantial completion.
46. Qualifications

B. Contractor shall be licensed with the State of New Jersey. Contractor shall (or contractually be supported by a company) specialize in fire alarm systems and have a minimum of five years of documented experience with the design and installation of the actual system and devices being installed.

C. Contractor shall have (or contractually be supported by a company) on staff and assigned to the project a NICET Level IV certified person for fire alarm systems. Such person shall have a minimum of ten years of documented experience in the design and installation of NFPA compliant local fire alarm systems.

D. The Contractor shall assign the NICET Level IV certified person to supervise the preparation of all technical documentation, drawings, installation, testing and acceptance testing as required by these specifications. The NICET Level IV certified person shall be present at shop drawing review meetings, design issue meetings and all acceptance testing.

E. Equipment manufacturer shall be a company specializing in NFPA 72 fire alarm and detection systems with a minimum of ten years of documented experience.
    1. All qualification documentation shall be submitted and reviewed prior to contract award.

F. Contractor shall assign to the project a project manager who is experienced in the installation of fire alarm systems. The Project Manager shall be assigned to the project as his primary responsibility. He shall be dedicated to the design, installation and successful completion of a complete and working system. The Project Manager shall demonstrate qualification through experience and/or education to the satisfaction of the Owner. The Project Manager shall supervise the preparation of all technical documentation, drawings, installation, testing and acceptance testing as required by these specifications. The Project Manager shall have a position within his/her company that allows him/her to make decisions and commit his/her company legally and financially so as to minimize corporate bureaucracy during the resolution of issues and problems.

PART 2 – PRODUCTS

7.1 MANUFACTURERS

A. Simplex

B. Siemens

C. Notifier

7.2 OR EQUAL – SEE SECTION 2.1.1

A. 2.1.1 Substitute equipment proposed as "equal to" or "or equal" equipment as specified in sections 2.1 and 2.2 shall meet or exceed the requirements of these specifications. This documentation shall be submitted for review and approval at the time of shop drawings.

B. The submitter of substitute equipment shall provide proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment. This proof shall be provided by an analysis of the substitute equipment against each system and component specified in 2.1 and 2.2. The analysis shall use a copy of each listed manufactures (Simplex, Siemens, Notifier) equipment

C. and specification manuals. The analysis shall compare the substitute equipment with the specified manufactures equipment by marking each paragraph as compliant or noncompliant as compared to the requested substitute equipment.

D. Along with the analysis, the submitter shall provide a letter from the substitute manufacture that certifies the information presented as either compliant or non-compliant, including a detailed explanation of each paragraph identified as non-compliant. The letter shall be signed and sealed by the substitute manufactures registered electrical engineer, substitute manufactures registered fire protection engineer or substitute manufactures NICET IV certified technician (in fire alarm).
   1. In order to ensure that the Owner is provided with a system that incorporates required survivability features, this letter shall also specifically certify that the system is capable of complying with the test requirements of this specification and quality testing as specified by the three listed products in section
   2. 2.1 and 2.2.

7.3 FIRE ALARM AND DETECTION CONTROL PANELS AND ASSOCIATED EQUIPMENT.

A. Networked Control panels shall be:
   1. Simplex 4100ES
   2. Siemens XLS
   3. Notifier 3030
   4. Or Equal – See section 2.1.1
   5. Networked Control panel(s) shall be point addressable and networkable using copper or fiber optic cable. Panels shall be surface wall-mounted enclosures unless otherwise approved by Design and Construction. All fire alarm panel and system design shall have alarm verification feature and environmental compensation for all smoke detection.
   6. Power Supply: Adequate to serve control panel modules, detectors, remote annunciator, door holders, smoke dampers (relays), initiating devices, amplifiers, and all alarm signaling devices.
      a. Initiating Circuits: Supervised, twisted/shielded circuits sufficient for remote addressable zone monitoring and capable of alarm and trouble indication at primary control panel. Each initiating circuit shall have a supervised addressable point which can be switched or have a programmed disconnect feature independent of all other initiating zones or points.
   7. Indicating Circuits: Supervised, twisted/shielded circuits sufficient for horn and strobe signal devices connected to system.
   8. Auxiliary Relays: Provide sufficient SPDT auxiliary relay contacts (for each detection zone) to provide accessory functions specified.
   9. Provide separate programmed switches to disengage door hold-open devices, elevator recall and HVAC shutdown.
      a. Provide TROUBLE ACKNOWLEDGE, DRILL and ALARM SILENCE switch.
      b. Control panel shall have historical record recordation ability inherent in panel memory for Alarm, Trouble and Supervisory signals. Historical record shall store a minimum of 600 events per signal type and be configured to record all events including but not limited to alarms, acknowledgments, power loss and related testing features.
   10. Surge Protector (AC transient suppresser, AC power).
      a. DTK-120SRD made by DITEK (or equal see Section 2.1.1). Suitable for protection of electronic equipment and electrical systems of 600 volts and less. Device shall be capable of protection of all AC electrical circuits and equipment from the effects of lighting inducted voltages, external switching transients, and internally generated switching transients resulting from inductive and/or capacitive load switching.
      b. Surge protector and installation shall be in accordance with:
         1 NFPA 70.

2 UL #1449 Standard for Fire and Safety-TVSS/SPD
3 IEEE Std. 142-Recommended Practice for Grounding Std. 518-Recommended Guide on Electrical Noise ANSI/IEEE C62.41-1991 Edition. Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
4 Federal Information processing Standards Publication 94 (FIPS PUB 94)
a Acceptable Manufacturers:
(1) DITEK Center 1720 Starkey Road Largo, FL 33771 1-800-753-2345
(2) Or Equals: See Section 2.1.1
(3) Surge Protection Panel enclosure shall be a minimum of a (NEMA 4) construction, factory primed and field painted to match mounting surface. See Appendix A-3 for arrangement detail.
(4) The SPD system as required shall consist of a Service Protection Panel for each service rated 600 volts or less, and/or Branch Panel Protectors. All devices shall operate as a total coordinated and engineered system, as well as be engineered as a system by the manufacturer.
(5) Maximum continuous operating voltages of any system component shall not be less than 115% of the nominal system operating voltage.
(6) All SPD components shall be rated with an operating temperature range of 30 to 120 degrees Fahrenheit, and from 0 to 85% humidity non-condensing.
(7) Nominal system frequently is 60 Hertz, operating frequency range of the SPD system shall be 0 to 400 Hertz.
(8) All SPDs shall be connected in parallel with the power system they are protecting. Series connected components shall not be used. Suppression paths shall not be ground.
(9) All SPDs shall be UL 1449 listed and bear the UL label.
(10) Remote Annunciator: Provide supervised LCD remote annunciator including audible and visual indication of fire alarm by zone, and audible and visual indication of system trouble. Install in recessed wall-mounted enclosure as specified. Remote annunciator shall provide the same English descriptor as all other required annunciation from printers, CRTs and fire alarm panel annunciator. Provide remote annunciator at all locations shown on drawings. Annunciation shall be remote LCD annunciator which shall indicate alarm, trouble and supervisory conditions by individual English descriptors. The remote LCD annunciator shall also be provided with a keyed switch or access code to perform system acknowledgment and system reset. Coordinate specific location with Owner.

11. IP Alarm Communicator - Keltron 922 IP Alarm Communicator shall be installed in a separate enclosure adjacent to the main fire control panel and shall not be installed inside of the main fire control panel. The enclosure shall be labeled "IP Alarm Communicator" and marked with its unique identifier number. The enclosure shall be of sufficient size to contain all components parts of the IP Alarm Communicators system to include the communicator, secondary power supply and like equipment. All wire connections between FACP and the 922 IP Alarm Communicators system and the fire alarm control panel shall be in conduit. The 922 IP Alarm communicator shall be provided and programmed by the Manager of Electronic Services and shall be installed by the Contractor.
12. Keltron Signal Communication Path. The fire alarm contractor/vendor shall coordinate with the project information technology contractor/vendor to ensure that the Keltron IT signal routing shall be through paths and devices that are provided with an emergency generator or UPS 8 hour power source.
13. When a Voice Evacuation System is required, the following shall be the minimum standard for Voice Evacuation Module:
14. Shall be based upon a 70 VRMS system.
    a. Install audio speakers wattage tapped based upon NICET IV recommended wattages. Each speaker wattage tap shall be shown on shop drawings for Owner review.
15. Amplifiers shall be sized with 40% spare capacity above wattages as listed on shop drawings. M4.

    Remote control and microphone must be in a lockable, flushed mounted cabinet.
    a. All voice evac speakers that are in public areas and are being installed in ceilings that are in excess of 10 feet above finish floor shall be 8" UL listed fire alarm speakers with back box and tile bridge support. All ceilings 10 feet or less and wall mounted speakers and speakers in non-occupied spaces may be 4" speakers.
    b. Audio voice evac shall be zoned, wired and configured to allow selective paging by floor and significant individual acoustic spaces.

c. Mechanical, utility and storage rooms are not required to have voice evacuation. These spaces may have a standard audio device.
d. M8. Voice Evac Speakers shall be Cooper/Wheelock based upon contractors recommendations and submittals. Proprietary addressable speakers may be considered on a project-by-project basis. All speaker color shall be white. All wall and ceiling speakers shall be multiple watt tap.
e. Voice zoning shall be on a project-by-project basis. Contractor/vendor shall consult with University Environmental Health and Safety for approval of zoning arrangement.
f. Contractor/vendor shall assume voice zoning on a per floor and per building wing basis.

16. Initiating Devices - General Requirements
17. Manual Pull Station: Double action, addressable. Flush and/or surface mounted as indicated by the specific building construction or drawings and as identified in Part 4 of these specifications. All manual pull stations must be keyed alike to the fire alarm control panel. Allen wrench opening devices not permitted.
18. Heat Detector in conditioned spaces: Shall be addressable combination rate-of-rise and fixed temperature, rated 135 degrees F for conditioned spaces. Contractor shall survey areas where heat detector is to be installed for possible need of higher fixed temperature rating.
19. Heat Detector in unconditioned spaces: Shall be Thermotech model 302ET or EPM anticipation type self- restoring rated at 194 degrees F or match existing. All heat detectors in unconditioned spaces shall be individually addressable through monitor zone actuated modules. Contractor shall survey areas where heat detector is to be installed for possible need of higher fixed temperature rating.
20. Smoke Detectors: Style and design shall be photo electronic with base having visual indication of detector actuation, bug screen and suitable for mounting on 4 inch outlet box and/or low profile wire mold back box. Detector and/or fire alarm panel shall have environmental compensation and provide automatic signal for dirty detector in advance of and prior to reaching alarm threshold. Smoke detection locations to include all Storage rooms, IT/NSS Server Rooms, Electrical Rooms, Common Corridors and Tops of Stairwells, unless otherwise specified by Design and Construction.
21. Note: When smoke detectors are provided for residential occupancies, the individual sleeping area audio devices shall be provided with 520 Hz square wave signal.
22. Duct Mounted Smoke Detectors: Style and type shall be photo electronic type with auxiliary SPDT relay contact, key-operated NORMAL-RESET-TEST switch, duct sampling tubes extending width of duct, visual indication of detector actuation and duct-mounted housing. Duct detectors must be provided with remote annunciation lamp at key switch mounted five feet above finished floor.
23. Remote annunciation lamp must be located in normal occupied area at the approval of the Design and Construction. Duct Mounted Smoke Detectors must be securely mounted "without possibility of vibration" and located for accessibility and ease of maintenance/testing. Duct detector shall be provided with a remote test switch: Key-operated switch may be on flush cover with lamp to indicate detector actuation. (Provide one switch for each duct mounted smoke detector). All flex connections from and to duct detector and fan/damper control equipment shall be installed in Sealtight.
24. Key-operated remote test switches shall be congregated together at eye height for testing convenience.
25. Signaling Devices
    a. Strobe Lights - where noted on drawings: Design and Construction choice based upon contractor submittal approvals. Style and type shall be visible notification appliances with 1Hz strobes. Contractor shall provide both wall mount and ceiling mounted visible appliance assembly with white housing and clear lens in accordance with NFPA 72, meeting the requirements of ADA. Where strobe lights are shown on the drawing to be mounted on walls, the strobe light shall be mounted at a minimum of 80" and a maximum of 90" above the finished floor.
26. Horn: Design and Construction choice based upon contractor recommendations and submittals. Device must be approved by Design and Construction. Color shall be white. Contractor must provide both ceiling and wall mounted versions.
27. Combination Horn & ADA Strobe: Design and Construction choice based upon contractors recommendations and submittals. Device must be approved by Design and Construction. Color shall be white. Contractor must provide both ceiling and wall mounted versions.
    a. Transmission of Signals: Transmit alarm, trouble and supervisory to the Universities designated central station service.
    b. Upon consultation with Design and Construction the fire alarm system shall also include an exterior alarm light and horn. The alarm light shall be a 360° revolving red light, weather tight seal and approved for use in exterior locations. Each exterior light shall be combined with an exterior audio horn in a weather tight enclosure approved for exterior use. The alarm light can be powered by ordinary building AC power and need not be provided with a secondary power

supply. Location of the exterior light and horn shall be as shown on the drawings and shall be coordinated with the Owner for elevation and placement.

c. Auxiliary Devices

7.4 DOOR RELEASE: PROVIDE 120 VAC ELECTROMAGNETIC HOLD OPEN DEVICES AS PER FIRE ALARM VENDOR'S RECOMMENDATION. ALL DEVICES SHALL BE MOUNTED FLUSH WITH FINISH WALLS WITHOUT USE OF CONDUIT OR WIREMOLD.

A. Fire Alarm Wire and Cable:

B. Fire Alarm Power Branch Circuits: Shall be wired in accordance with NFPA 72 Local Fire Alarm Regulations and NFPA 70, Section 760. Each power source shall be obtained from an emergency power circuit and the breaker shall be marked "FIRE ALARM POWER SOURCE" and be provided with a "red" locking device so as to prevent accidental power loss. Contractor shall be responsible to run all power from the closest emergency circuit panel to the fire alarm system.

1. All fire alarm cabling including Initiating, Signal and Communication Buss Circuits: Shall be Aerospace Wire & Cable Inc., Aerospace as follows:
   a. #7140 18/2 TW/SH 200 deg.C. FPLP (New York City Certified)
   b. #7130 16/2 TW/SH 200 deg.C. FPLP (New York City Certified)
   c. #7120 14/2 TW/SH 200 deg.C. FPLP (New York City Certified)
   d. #7110 12/2 TW/SH 200 deg.C. FPLP (New York City Certified)
2. Any and all fire alarm cable used in this system shall be "solid copper" conductors. No exceptions.
3. Important Note: 12 inch wire samples for 18 T/S, 16 T/S, 14 T/S and 12 T/S shall be submitted at the time of shop drawing submittals and prior to material purchase and installation. Wire samples shall be approved by Owner prior to purchase.
   a. "Or equal" for wiring: See section 2.1.1
4. Recommendation: contractor to purchase and use Cyclops Data Cable Stripper Ideal #45-514 Wire Stripper to strip the Aerospace wire to make project easier and minimize wire damage.
5. Use 14 AWG (minimum size) twisted/shielded solid conductors for fire alarm indicating circuit conductors. All communication bus cable shall be 18 AWG twisted/shielded solid copper wiring using fire alarm listed plenum cable in all exposed areas. Any area subject to moisture or the effects of weather shall use water resistant conduit, enclosures, fittings, adapters, and like equipment. This includes all exterior mounted devices. Weather tight and water resistant installation shall extend for 12 inches within building envelope.

PART 3 – EXECUTION

8.1 INSTALLATION

8.2 INSTALL SYSTEM IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS, CODE REQUIREMENTS AND THESE SPECIFICATIONS.

8.3 ALL DEVICES, BOXES AND CONDUIT SHALL BE INSTALLED PLUMB AND LEVEL.

8.4 INSTALL MANUAL PULL STATIONS WITH OPERATING HANDLE AT 48 INCHES ABOVE FINISHED FLOOR. INSTALL AUDIBLE AND VISUAL DEVICES AS NOTED ON DRAWINGS. ALL WALL MOUNTED VISUAL DEVICES SHALL BE MOUNTED NO LESS THAN 80 INCHES ABOVE FINISHED FLOORS.

A. All devices shall be securely mounted with approved back box. All back boxes shall be recessed in walls or of an approved surface mount, wire mold type. Standard back boxes and extension rings with knockouts are not permitted when location requires surface mounted box. Contractor must use a finished back box suitable for painting. Only approved and appropriate type of conduit connectors shall be used for connection to back boxes.

1. Note: It is the intent of this section to only allow recessed fire and device installations in wall and ceilings of finished spaces. Wire mold and surface mounted conduit will only be permitted by Design and Construction on a case-by-case basis at the time of shop drawings. Contractor shall bid the project to exclude surface mounted wiring and devices and approach surface mounting on an individual basis only. All surface mounted devices, conduit or wire mold shall be clearly shown on the drawing in a color specified by submittals details previously listed in this specification.
2. All wiring for initiating, signaling and auxiliary devices shall be installed in "red" Allied Tube Fire Alarm EMT or equal conduit except those areas where the wire can be fished in walls or hung above suspended ceilings. When wire is installed above ceilings and not in conduit, it must be run above the

bottom of any red steel (or other type of super structure) and supported every 4-1/2 feet by a J strap or other Design and Construction approved support device. Wiring shall not be laid directly on a ceiling or supported by pipes, duct work or other building equipment. All wiring shall be secured within 12 inches of all junction boxes, back boxes, other devices or splice connections. All conduits shall be secured to building structure every 4 feet. When construction is of a wood frame, wire staples shall not be used to secure wire in place of J straps.

3. All fire alarm cabling and/or devices which are installed within 10 feet of water or sprinkler equipment shall be installed in Sealtight conduit with liquid tight connections and liquid tight (waterproof) boxes. When there are three or more monitoring/alarm points within the same area, monitor relays shall be mounted with a NEMA 4 Hoffman.
4. Mount end-of-line (EOL) devices in a backbox. All end-of-line resistors shall be landed on terminal strips mounted into device back boxes or appropriate electrical enclosures or in a separate junction box adjacent to the last device in circuit. Each EOL device back box shall be labeled "EOL" and be visible from front of device. If "EOL" is mounted in separate junction box, the face of the box shall be labeled. All end- of-line device leads shall be insulated from short conditions by use of approved heat shrink wire insulation.
5. All wiring connections to sprinkler system water flow switches, sprinkler and/or fire pump system valve tamper switches, fire extinguishing systems, duct detectors and building interface equipment shall use conduit to within ten feet of device wherein the conduit shall terminate at a junction box. From the junction box to the device, the fire alarm wire shall be run in an approved Sealtight conduit and secured at each connection point to withstand a 50 pound pull force.
6. Automatic Detector Installation: Devices shall be installed as per the manufacturer requirements, NFPA 72 and these specifications. All detectors shall be securely mounted with approved back box. All back boxes shall be recessed. Only approved and appropriate type of conduit connectors or strain relief connectors shall be used for connection to back box.
7. Any wire entry or exit from a device, conduit or Sealtight shall be through an appropriate and approved box which is designed and installed to prevent chafing, cutting or other damage to the cable. All connections to devices, boxes, back boxes and like devices including any wiring exiting properly terminated conduit or EMT shall be provided with strain relief sufficient to secure cable at the point of entry or exit. Strain relief from back boxes, devices junction and panel boxes for wire cable shall consist of Arlington Ind., Inc LPCG50 connectors for single cable entry and Arlington NM 840 series for multiple cable entry.
    a. Any conduit that is installed within areas subject to moisture, rain or water drainage shall be installed using approved water resistant and watertight conduit, enclosures and like equipment.
8. All system devices, panels and junction boxes shall have a unique identifier number which shall be:
    a. Labeled on each device, panel and junction box with a durable label capable of surviving environmental conditions.
    b. Labeled on all drawings.
    c. Labeled on all parts lists and required testing documentation.
    d. The unique identifier numbering system shall be approved by the Owner at the time of shop drawing submittals.
        1 Label for smoke detectors shall be installed on the base and readable from the floor at a distance of 10 feet.
9. Note: The intent of this requirement is to have each and every device and component (except panel components) installed with a logical and unique number whereby all inventory, documentation and life effort can be tracked by the unique number. Device labels shall be designed and installed to have a survival life of 10 years. Labels shall be positioned in a consistent location on each type of device.
10. Each conductor (individual wire) shall receive a unique and durable wire number at each terminal block, slice connection, device terminal and any other location where a conductor is landed. Only "Brady Permasleeve" heat shrink wire markers will be permitted. No other label/marker systems shall be approved. In areas where the atmosphere is unconditioned, the wire number shall be protected with a clear heat shrink protector sleeve.
    a. System devices that are located above a suspended lay-in ceiling shall have the heat shrink wire markers installed on each cable 12 inches before entering the back box and 12 inches after exiting the back box.
    b. Cable labeling in junction panels, control panels and other covered boxes shall have the shrink wire marker installed at the end of the cable prior to the protective heat shrink stripping cap. See wiring detail on bid drawings.
    c. Each wire number shall be shown on the final as-built drawings or on a separate approved document which shall be included in the final documentation and describes the wiring to each device as follows:

1 Device Circuit In From/ Last/Next

Wire
2 Type

Out to

Termination No.

Type Color
3 ----------

8.5 THE POWER SUPPLY SURGE SUPPRESSION DEVICE(S) SHALL BE INSTALLED IN A SEPARATE NEMA 4 ENCLOSURE ADJACENT TO EACH FIRE CONTROL PANEL AND SHALL NOT BE INSTALLED INSIDE OF THE FIRE CONTROL PANEL. THE SURGE SUPPRESSION ENCLOSURE SHALL BE LABELED "POWER SUPPLY SURGE SUPPRESSION" AND MARKED WITH A UNIQUE IDENTIFIER NUMBER. THE SURGE SUPPRESSION ENCLOSURE SHALL BE OF SUFFICIENT SIZE TO CONTAIN ALL COMPONENTS OF THE SURGE SUPPRESSION SYSTEM AND INCLUDING TERMINAL STRIPS. ALL WIRE CONNECTIONS BETWEEN THE SURGE SUPPRESSION DEVICES AND THE FIRE ALARM CONTROL PANEL SHALL BE IN CONDUIT. IT IS THE INTENT OF THIS SPECIFICATION TO REQUIRE ADDITIONAL AND REDUNDANT SURGE SUPPRESSION PROTECTION FOR ALL SYSTEM COMPONENTS WHENEVER THEY RECEIVE AC OR DC POWER.

A. When installing wire numbers at back boxes, the wire numbers shall be installed on each cable inside of the back box when the back of the back box is not accessible (i.e. when the back box is installed on hard ceilings, on concrete or block surfaces or in gypsum walls). If the back of the back box is accessible, then the wire number shall be installed as listed in section M (1) above. See Appendix A-2

B. The labeling of system devices and other equipment may be accomplished by using a P-touch type labeling system. No hand written labels or "Sharpie" markers will be permitted.

C. Traditional wire ties are permitted for use in the system to secure wire bundles. The contractor shall provide written instruction to each employee on the correct use of wire ties so as to avoid compression of the cable jacket, shield or conductor insulation. Wire ties may not be used to secure cables to J strap, building structure, back boxes, panel enclosures, conduit or as wire restraint at device and other terminations.

D. All terminal blocks, cards, relays and other devices shall be rigidly mounted within a cabinet enclosure or back box using screws, bolt & nut or epoxy glue. Double back tape or similar mounting systems shall not be permitted.
   1. Wire terminations, splice connections and all other connections shall be made by the use of UL listed compression terminal blocks as follows:
   2. All panel and junction box connections:
      a. "Square D" 9080 GM6 Terminal Blocks, 600V, 30A with Din Rail or equal.
   3. All back box connections for shields and small connections:
      a. "Ideal" #89-608 Barrier Strip, 600V, 20A or equal
      b. No wire nuts or crimp connection devices will be approved. When terminal blocks are added to devices which incorporate a pig tail, the terminal block shall be securely mounted with mechanical fasteners (no double back tape) in the back box or on the back of the fire alarm device.
      c. All Din Rail terminal blocks shall be provided with a number which shall be shown on all panel drawings and as-builts along with wire numbers.
   4. All conduit, devices and other system components that are installed in areas subject to moisture, water, rain or water drainage shall be installed using approved water resistant and water tight conduit, NEMA 4 enclosures and like equipment.
   5. Provide power supply wiring to fire alarm system components from building electrical panel. Circuit breaker shall be sized in accordance with fire alarm system demand and the NEC. Branch circuit breaker shall be clearly labeled for fire alarm service, contiguous to the circuit breaker toggle switch and the toggle switch shall be provided with a lock to prevent accidental movement. See Section 3.1 (M) for labeling requirements.
   6. Provide all low voltage signal wiring for systems specified herein in a workmanlike manner. Provide system raceways in accordance with manufacturer's requirements for installation of system's wiring.

Provide and tag conductors at all junction and terminal points and identify by same number on all shop

7. drawings. All conduit, cable, outlet and mounting boxes required as part of mounting arrangements shall be color-coded red if not in public area.
8. Protect exposed wiring installed above ceiling construction from physical damage where necessary by conduit, guard strips or other approved means. Install all drops to wall devices fished in walls. Properly support all low voltage cables and conduit from the building structure by the use of J straps. At those points where the wire descends below the concrete/steel structure, the wire must be provided with adequate strain relief which is designed not to cut or ground the cable shields. The wire shall descend plumb to the device or transition. Secure cable in place at intervals not exceeding 4-1/2 feet and within 12 inches from every cabinet, box or device. Cable stress relief shall be required for all connections to devices and boxes.
    a. In running plenum cable not in conduit, all J straps running parallel with red steel (and/or wood framing) shall be turned up on the bottom flange of red steel (and/or wood framing) so as the wire run is on top of the bottom flange and cradled by the bottom flange. Where intersecting beams must be crossed, the wire run shall be routed as follows:
        1 When a corrugated steel flute is available above the red steel, the wire shall be routed through the flute and over top of the steel beam.
        2 When a corrugated steel flute is not available, the wire run shall be taken under the intersecting beam and held off the beam by J strap on each side.
        3 When running wire through wood flooring and truss members, the wire shall be secured so as not to be exposed to metal gusset edges or other metal objects that could cause damage to the cable from weight, strain or vibration over time.
9. When any wire run transitions from above a suspended or hard ceiling into a room or area which has no ceiling, the entire wire run shall be run in red EMT through the entire room or until the red EMT terminates within a junction or back box. The intent of this requirement is to not permit any exposed plenum wire in areas without ceilings.
10. Install all fire alarm wiring in separate raceways. Do not mix 120 volt AC power with fire alarm initiating, signaling or communications cable in the same raceway. All 120 volt AC power wiring shall be separated from initiating, signaling or communications cable inside of FACP, NAC or junction boxes with a paper or fiber board separation.
11. Be responsible for assuring that conduit sizes and the wire quantity, size and type are suitable for the equipment and conditions as they exist. Review the proper installation of each type of device with the equipment supplier. Make final connections between the wiring and equipment under the supervision of equipment manufacturer's certified technician and NICET IV person in charge.
12. Be responsible to seal all floor, ceiling and wall penetrations with approved materials which will provide the equivalent fire resistive rating as that of the wall, floor or ceiling that was penetrated. Contractor shall also be responsible to re-seal or repair any access ways or penetrations made through draft stops or fire stops with materials and workmanship which equals the original intended fire rating of the draft stop. All fire penetrations shall be sealed the same day of penetration.
13. All fire alarm wiring which is not concealed above ceilings, fished in walls, or run in Sealtight, shall be installed in conduit and/or wire mold unless specified otherwise on drawings.
14. Elevators: Smoke detectors shall be located outside each elevator landing in accordance with NFPA 72 and programmed to recall the protected elevator. Heat detectors shall be located within two feet of each sprinkler head that is located within the elevator machine room. The FACP shall be programmed to shunt trip the elevator upon activation of the machine room heat detector.
15. Where required, all smoke detectors and alarm monitor or control devices which are to be installed under a raised floor shall be provided with an approved drip shield to protect the device from water that could drip from above or on top of the raised floor surface. Each device shall also be provided with LED annunciation at an approved location. The design and installation method shall be proposed by the contractor and shall be subject to the approval of Design and Construction at the time of shop drawings.
16. All junction and termination boxes using Din rail shall have a hinged cover with a latch, or keyed locked keyed alike to the primary FACP. Box covers with screws or other fasteners will not be accepted. This includes surge suppression and similar enclosures.
    a. Wire Jacket Ends and Shield Drains
    b. All signal, communications and power wire (low voltage) shall be twisted/ shielded as specified in Section 2.6, B. There shall be no use of unshielded cable on the project with the exception of 120 VAC power to surge suppressors and system power supplies. All cable and shields shall be installed as follows:

1 Initiating circuits: all shields shall be carried through each device back box through the use of a compression terminal block as specified in Section 3.1 (R) of these specifications. Each shield drain wire shall be insulated with "clear" heat shrink wire insulation installed from the cable end heat shrink strip to the terminal block. The shield shall be landed at the "panel end" as per manufactures recommendations. The "field end" of the shield shall be terminated in the last device back box at the compression terminal strip. •

See Appendix Detail A-2

2 Indicating horn, speaker (where applicable) and strobe circuits: all shields shall be carried through each device back box through the use of a compression terminal block as specified in Section 3.1 (R) of these specifications. Each shield drain wire shall be insulated with "clear" heat shrink wire insulation from the cable end heat shrink strip to the terminal block. Shield landing shall be as follows:

a In NAC panels, the shield shall be landed on an acceptable ground at the junction panel (See Section 2.2 F) located adjacent to the NAC panel. The field end of the shield shall be terminated in the last device back box, in the compression terminal strip.

b In FACP or transponder/data collection panels, the shield shall be landed as specified by the system manufacturer.

c See Appendix Detail A-2

(1) Communication, signal and data circuits shall be carried through each device junction box, back box, or other enclosure necessary through the use of a compression terminal block as specified in Section 3.1(R) of these specifications. Each shield drain wire shall be insulated with "clear" heat shrink wire insulation from the cable end heat shrink strip to the terminal strip. The shield shall be landed at the panel as per manufactures recommendations. The field end of the shield shall be terminated in the last device back box, in the compression terminal block. See Appendix Detail A-2

17. Wire stripped ends shall be protected with "red" heat shrink insulation placed at the cable jacket end to insulate the transition from the cable to the stripped drain wire.
    a. Field Quality Control
    b. All system testing shall be in accordance with NFPA 72 and these specifications, Part 5.
18. Contractor shall be responsible to install all system components, wiring and conduit in a workmanship like manner and to the satisfaction of the Owner. Design and Construction shall determine the acceptable level of workmanship. Examples of existing installations or other contractor installations shall not be used for evaluation of acceptable workmanship under the fire alarm contract work. Only the highest quality workmanship will be accepted. There are no exceptions to this requirement.
    a. Fire Alarm Wire and Cable Color Code
19. Provide fire alarm circuit conductors with color coded insulation, or use color tape at each conductor termination and in each junction box. Color code shall be specified by the Contractor at the time of shop drawings and shall be consistent throughout all fire alarm systems. Color code shall be listed on all shop and as-built documentation/drawings.
20. Electrical Service for Installation Operations
21. Contractor may use any existing electrical service, outlet or system available where approved prior by Design and Construction. Contractor shall not assume that evidence of existing outlets implies energized circuits.
    a. When electrical service is not available, the contractor shall provide his own electrical supplies from generators or other suitable service.
22. Contractor shall provide all necessary cords, leads, generators and other necessary equipment required to perform installation, testing and demolition work.
23. Ceiling Device Installations
24. All installations of ceiling devices including smoke detectors, horns, speakers and strobes and where installed in a suspended lay-in ceiling shall be provided with a ten foot coil of wire. The wire coil shall be secured at the floor/roof deck level just prior to the device drop using a "lose secured wire tie" so as not to crimp wire shields. In the case of minimal space above a suspended ceiling, the coil shall be secured to a J strap or other approved mounting point.
25. Fire Alarm Control Panel Installation
    a. All field wiring within the fire alarm control panel shall be dressed and cornered. Wiring shall be run parallel with 90 degree bends for directional changes. Wire straps if applied shall not compress wiring jackets.

26. All field wiring shall be terminated in a junction box located above or beside the main fire alarm control panel. The junction box shall be provided with terminal strips and segregated into four parts as follows:
27. power, 2) initiating, 3) Signaling and 4) Other. The junction box cover shall be hinged and operable with a standard screwdriver or keyed device.
28. Note to Contractor: The system installation at the FACP location will include a minimum of five enclosures "all keyed a like" as follows:
    a. FACP enclosure(s)
        1 Battery enclosure(s)
            a Wiring junction box as described in 3.7(B)
                (1) Surge protector enclosure as described in section 4.2.1
                (2) Documentation cabinet as described in section 5.4.1
29. Other enclosures may be necessary such as NAC, Support cans, wire trough, etc.
30. Visual Strobe Synchronization
31. All visual strobe devices that are within the same viewing area must be in synchronization. The contractor and equipment vendor shall provide a design and installation that meets the requirements of NFPA 72, Section 7.5.4.3.2.

8.6 PART 4 – ALARM ACTIVATION SEQUENCE

A. Sequence of Operation. As a basic operation of the system the designer shall include at a minimum the following sequence of operations;

B. Upon any fire alarm:
1. All audio and visual alarms to sound throughout the building or fire area as applicable and said fire area shall be identified and approved by Design and Construction.
2. Annunciate specific device or zone in common plain English at the Fire Alarm Control Panel, printer and remote annunciators in plain English description. Annunciation descriptors shall be the standard terminology used by the University for the specific building and for each area within the building. Descriptors shall not be abbreviated. All terminology and descriptors shall be approved by Design and Construction at the time of shop drawings.
3. Cause transmission of an alarm signal to the University's remote station service.
4. Deactivate electro-magnetic door hold open devices.
5. Output fan shut-down if affected air handler is involved.
6. Activate other outputs as required by design.
7. Note: A general alarm device signal is any device signal that is not identified as a special or supervisory device signal.
8. Special systems may require a special operation sequence. Each special system shall be reviewed by Design and Construction and approved. Upon activation of any supervisory or trouble alarm shall cause the following:
    a. Annunciate specific device or zone in common plain English at Fire Alarm Control Panel, printer and remote annunciators in plain English description. Annunciation descriptors shall be the standard terminology used by the University, for each area. Design and Construction at the time of shop drawings.
    b. Cause transmission of the supervisory or trouble alarm signal to the Rowan University's Remote station service.
9. Fire Alarm System - Additional Requirements
    a. Fire alarm system (including subpanels, transponders, DGP's or NAC's) power supplies shall be protected with separate surge protection in the power supply line feeding the fire alarm panel, releasing panel and NAC. Surge protection as per 4.1, shall be redundant and independent of any surge protection provided in and listed for the fire alarm panel. The surge protection device shall be located within 5 feet of the fire alarm panel, sub panel, transponder or NAC, and be labeled "surge protection, fire alarm panel ##". The surge protection shall be mounted in its own NEMA 4 electrical enclosure with label on exterior of enclosure.
    b. Spare Parts. Contractor shall include in the base bid the cost to provide all manufacturer's recommended spare parts and devices. At a minimum, the Contractor shall provide at the final acceptance test the following spare parts and devices:
        1 One smoke detector of each type used on the project.
            a One heat detector of each type used on the project.
                (1) One manual pull station of each type.
                (2) Two of each type of fuse used in each fire alarm system.
                (3) One audio device of each type used on the project.
                (4) One visual device of each type used on the project.

(5) Included shall be any remaining devices not installed under the provisions of section 4.1.5.

10. All spare parts shall be listed on all inventory lists and each spare part shall be labeled for the specific system or component it is intended.
11. All secondary power supplies (batteries) shall be calculated in accordance with NFPA 72 and manufacturer's recommendations and shall include design spare capacity. Battery size shall be increased by 25% above minimum calculation.
12. Special Conditions
13. Contractor shall conceal all conduit and wiring above ceilings where applicable. The decision to allow exposed conduit shall be made by Design and Construction at the time of shop drawings. Any exposed conduit or wiring shall be clearly annunciated by the Contractor through the use of color code or other annunciation method on the shop drawings so that it can be easily identified during shop drawing review.
14. Contractor shall connect and monitor all alarm, trouble, and supervisory points for each fire suppression, fire pump and fire extinguishing system to the fire alarm system. It shall be the responsibility of the contractor to coordinate with Design and Construction to identify any and all such systems prior to development of shop drawings.
15. All manual pull stations and wall mounted devices shall be recessed and flush mounted with conductors concealed within wall or structure. This includes existing masonry surfaces. If an existing condition exists that will not permit recess and flush mounting (reinforced concrete or filled masonry block), then the contractor shall plan to saw cut/channel the masonry wall to install the raceway and pull station. In the rare event that the Owner approves an alternate of surface mounted wiremold, all wiremold shall be flush against the wall or mounting surface without any space or bends. All wire mold raceway shall enter an approved wire mold back box flush against the wall or mounting surface.
    a. If wire mold is approved and installed for this project, it shall be metallic and fastened flush to the wall surface without spaces under the wire mold. Any spaces created by wall surface deviations such as mortar joints and like transitions shall be filled with an appropriate paintable caulk. All wire mold shall be uniquely marked on the shop drawings to show all locations proposed for use.

8.7 PART 5 - ACCEPTANCE, TESTING, AND DOCUMENTATION

A. General

B. All fire alarm systems, component parts, and supervisory functions shall be subject to acceptance testing to be conducted by the Contractor. The system shall be completely operational, finished and ready for acceptance testing in accordance with the anticipated project schedule.

C. Design and Construction shall be notified at least 15 working days prior to acceptance testing with the specific date, time and system being tested.

D. All approvals (with the exception of the acceptance test approval) required by these specifications shall be completed and submitted with the notification of acceptance test date as required under 5.1.2.

E. All as-built completed drawings required by these specifications shall be completed and submitted with the notification of acceptance test date as required under 5.1.2.

F. All Contractor field testing and manufacturer testing documentation as required by these specifications shall be submitted with the notification of acceptance test date as required under 5.1.2.

G. Contractor shall provide Rowan University with three complete manuals of "the specific" fire alarm system being tested. The manuals shall document all components of the system identified by unique number, consistent with the shop drawings and "as-built" drawings.

H. Contractor shall provide all items identified under Sections 5.1.3, 5.1.4, 5.1.5 and 5.1.6 in bounded and labeled three-ring binders with zippered ends. The binders shall be labeled on the cover as follows:

I. Rowan University, "Name of Building", i.e. Bunce Hall Fire Alarm & Detection System

J. Each section of the manuals shall be arranged with section tags and documentation as follows:
    1. Project Cover sheet listing project name, contractor, vendor, and consultant.
    2. Manual index.
    3. Service Directory.
        a. Fire Alarm Approvals. Include:
            1 Copy of Fire Marshal Application for fire protection plan review, completed and marked paid.
            2 Copy of Fire Marshal's Office plan approval form.
            3 Copy of Fire Alarm Signaling Systems Company License.

4 Copy of NICET Certification, certificate of technician.
5 Original of NFPA 72 Fire Alarm System Certification and Description.
6 Copy of Fire Marshal's System Inspection and Final Approval Form.
a Narrative of system description and operation. Include original design notes for basis of design.
(1) System installation and service manual. (Note that these are two separate documents.)
(2) Equipment inventory list, with unique identifier labels for each device. Include equipment data sheets.
(3) Parts list of all components, modules, devices, wiring harness, and cross referenced with unique identifier number/label.
(4) Divider section labeled "Punch List Items".
(5) Manufacturer/vendor system testing. This section shall contain all installation, check-out and acceptance testing data as per these specifications.
(6) First year warranty and test schedule.
(7) Wire list.
(8) Alarm and Supervisory Zone Descriptor. As worded using actual plain English descriptors.
(9) As-built drawings. To be installed in protective clear plastic sleeves. One drawing per sleeve.
(10) CD or other acceptable media with an electronic copy of AutoCAD as-builts.
(11) All documentation listed in this section shall include a digital copy on a "thumb-drive" device included with each binder. This includes all as-built drawings, PDF copies of manuals, approvals and items as listed in section 5.1.7 (c) through (n).

4. At the conclusion, the Contractor shall document each part or test result from the acceptance test in a form suitable for installation into the required three-ring zippered binder. It is recommended that the test data collected in the acceptance be performed and documented during Contractor's system check- out and documented in binder prior to delivery to The Owner. If this recommendation is accepted, acceptance test will be performed much faster and any delays in release of final payment will be avoided.
5. The Owner acceptance of system shall not be completed until all faults, malfunctions and documentation as required by these specifications have been completed, delivered and verified by Design and Construction.
6. Fire Alarm System Testing
7. The fire alarm system shall be tested in accordance with the guidelines set forth in these specifications and NFPA 72. All testing shall be documented in a report form to Design and Construction and in accordance with section 5.1.6 of these specifications. A written copy of testing documentation shall be provided to the fire marshal at time of acceptance testing. Documentation and testing shall consist of each item noted in NFPA 72 and the following:
   a. Stray voltages between circuit conductors and ground. Verify compliance on as-builts.
   b. Ground faults on all conductors other than those intentionally and permanently grounded should be tested for isolation from grounding using an isolation testing devices such as a "megger". Documentation of "megger" testing shall identify each conductor in note form on as-builts or in ledger form identifying tested conductor and test results. Discussion of means and methods for meggering shall be reviewed at the time of "kick-off" meeting.
   c. Short circuits on all conductors other than those intentionally and permanently connected together for conductor-to-conductor isolation. To be verified on as-builts.
   d. Measure and record on as-builts loop resistance with each circuit pair short-circuited at the far end of the circuit with an ohm meter and record the resistance on each circuit as shown on the as-builts.
8. Manufacturer's representative check. Prior to placing power to the system, a Manufacturer's representative check-out shall be conducted and verified in writing to the Owner under the requirements of Section 5.1. The report shall contain the following, but shall not be limited to:
   a. A complete list of equipment installed and wired.
   b. Indicate that all equipment is properly installed and conforms to the manufacturers and these specifications.
      1 Test individual devices in accordance with NFPA 72 acceptance test criteria Chapter 2, 3, 4, 5, 6, and 7.
      2 Technician's name, manufacturer certification, and date.
         a Test of individual inputs and outputs for intended function and supervision.

(1) Test to verify the functional operation of the central monitoring point and remote annunciators individually and as a complete system under the following conditions:
(2) Normal operational condition
(3) Alarm condition
(4) Under primary power failure
(5) Test and demonstrate proper coordinated interfaces with HVAC, suppression and extinguishing systems and any other interfaced system or device, under the following conditions:
(6) Normal operational condition
(7) Alarm condition
(8) Under primary power failure
(9) Output function features
(10) Measure, adjust, and record each smoke detector (including duct smoke detection and beam detection), to its medium sensitivity setting. This must be performed at the operational location of the unit and under normal environmental conditions. The sensitivities shall be recorded with serial number, location number and model number for each detector. Confirm that smoke detectors are
(11) within their UL listed sensitivity production window. All sensitivity testing shall be recorded in the documentation or as-builts as required under Section 5.1. All sensitivity recordation shall be in "percent per lineal foot light obscuration", not voltage, using an approved smoke detector sensitivity testing apparatus as listed by the manufacturer.
(12) Confirm and document that all alarm point annunciation descriptors are correct, in compliance with shop drawings, presented in plain unabbreviated English, and are annunciated to all remote annunciators and printer as required by these specifications.

8.8 UPON COMPLETION OF FIRE ALARM TESTING, THE CONTRACTOR AND RESPECTIVE MANUFACTURER'S AUTHORIZED FIELD ENGINEER SHALL CONDUCT FUNCTIONAL AND INSTRUCTIONAL TESTS FOR DESIGN AND CONSTRUCTION UNDER THE GUIDELINES OF SECTION 5.1 AND 5.3.

8.9 ACCEPTANCE TESTING SHALL BE SPECIFIED BY THE CONTRACTOR (SEE REQUIREMENTS 5.2.1). THE CONTRACTOR SHALL DEVELOP AN OUTLINE FOR APPROVAL BY THE OWNER, BUT AT A MINIMUM, THE TESTING SHALL BE AS FOLLOWS:

A. Confirm all documentation has been received: As-builts - check accuracy
1. plan views
2. riser diagram
3. panel drawings
4. battery calculations
5. Disk labeled
6. Thumb drive
a. Manual - check content
1 system descriptions
a parts list
(1) spare parts inventory
(2) device cut sheets s installed
(3) schedule for first year's maintenance and testing
(4) testing documentation of devices and system
(5) Inspect panel for installation, power, etc.
(6) General walk-down of devices to identify any missing device or obvious problems.
(7) Test alarm and annunciation circuits for audio level with dB measurements. Test shall provide an audible alarm with each device on alarm during acceptance testing, hit alarm silence and go on. No walk test mode permitted for acceptance testing.
(8) Test of battery backup.

(9) full load test for five minutes
(10) test and record voltage during full load test
(11) test and record amps during full load test
(12) test and record recharge amp rating
(13) test and record battery draw during full load
(14) normal standby mode in amps
(15) test and record battery recharge voltage no load = vac
(16) test and record battery recharge voltage with load = vac
(17) Test of primary power.
(18) voltage=vac/vdc
(19) circuit breaker tagged and locked open
(20) surge protection under full load after
(21) system has been operating on secondary power for 24 hours
(22) Audio/Visual circuit amp loads.
(23) circuit #1 = amps
(24) circuit #2 = amps
(25) etc.
(26) Inspect panel boards for faults.
(27) Check spare capacity of system.
(28) Check supervision of all circuits, signal and detection.
(29) A random sample test of detection, supervisory and pull station devices for function, supervision and proper installation.
(30) Confirm English descriptors and labels for zones.
(31) A random inspection of junction boxes, terminal/splice point boxes, conduit, wiring and general installation features. Goal of inspection is review of installation for workmanship and specification issues.
(32) Copies of hard and magnetic media of software.
(33) Additional test as required by individual system design or arrangement.

b. The Contractor shall be responsible to conduct all acceptances testing with the Contractor's calibrated equipment, in the presence of Design and Construction. The Contractor shall submit at the time of acceptance test notification and outline similar to the one listed in 5.2.3 for approval by Design and Construction.

7. Audio Acceptance Testing and Adjustments. At the time of acceptance testing the contractor shall conduct the standard NFPA 72 audio level testing throughout the building. In addition, the contractor shall conduct specific audio measurements for any voice evac area. Based upon the readings, if audio levels are not adequate, the contractor shall adjust horn/speaker wattages to bring the audio levels into compliance with minimum code levels.
8. If the system is a Voice Evac system using speakers as specified by this specification, the contractor shall include in his base bid price sufficient labor to adjust 25% of all installed speaker locations from their original wattage tap to an appropriate up or down tap.
   a. Once wattage taps are adjusted, the contractor shall re-conduct the same audio readings and record the final audio levels on a set of as-built drawings for submission with final documentation as specified in these specifications.
   b. At the conclusion, the Contractor shall document each part or test result from the acceptance test in a form suitable for installation into the required three-ring zippered binder.
9. Rowan University Instruction
10. Contractor or Manufacturer shall provide Rowan University's representatives with a minimum of two, two hour classes of formal instruction on the operation, maintenance, service and testing of the fire alarm system, devices and related building interfaces. The instruction shall be scheduled after acceptance testing but prior to final payment.
11. Contractor and/or Manufacturer shall provide to the Design and Construction an instructional outline for each class with all visual aids. All classes shall be structured consistently with traditional educational standards with performance objectives and testing for all participants. Each student shall receive an instructional certificate indicating number of hours of instruction and satisfactory completion of the course. Owner may video tape class for future use.
12. Documentation
    a. Prior to acceptance testing the Contractor shall purchase and install a documentation cabinet adjacent to the primary fire alarm panel. This documentation cabinet shall be keyed alike with the fire alarm panel and shall be large enough to contain a complete set of documentation as

described in these specifications. The cabinet shall be the same color and match the fire alarm panel.

8.10 PART 6 – DEVICES LABELING AND SOFTWARE

A. Device Demarcation

B. Each and every alarm initiating device, supervisory device, monitoring device, control panel and junction box shall be provided with a unique number which shall be intended to specifically identify that item uniquely within its parent system. The unique number shall be clearly marked on the face of the device so as to be visible from 10 feet from a normal visual position. The type and style of unique label shall be approved by the Owner prior to installation. It shall be a type of label that will survive for a minimum of 10 years under installed conditions.

C. The unique number shall be an identifier within a logical system and numbers shall be assigned in a logical and systematic order.

D. The unique number shall be shown on all shop drawings and other documentation that annunciates, describes or documents said item. This would include inventory listing, materials lists and manuals submitted under Part 5 - Requirements.

E. Software and Programming

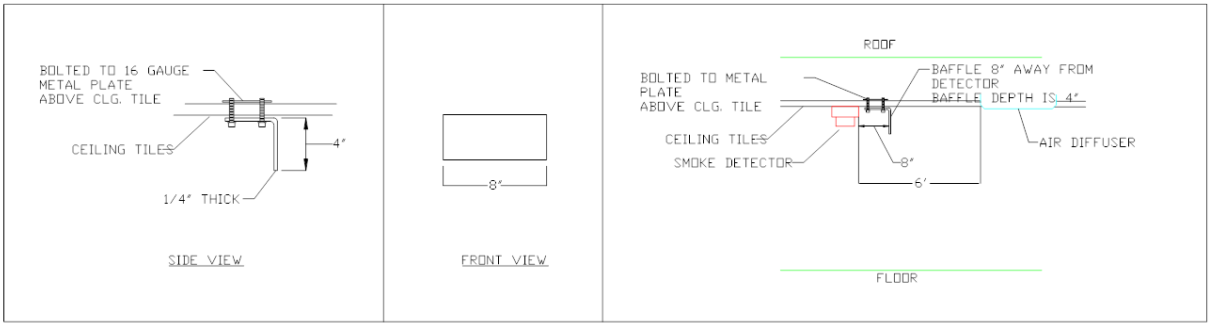
F. Copies and adequate explanatory documentation of all software and programming used in the fire alarm system shall be provided to the Owner within 30 days after acceptance testing approval.

G. The Owner shall own all software and programming that is part of the operational, updating, renovation and maintenance need of the system.

1. If it is a condition of the Contractor or Manufacturer to require licensing of any software or programming, the Contractor and/or Manufacturer shall provide such licensing to the Owner as part of this project. Cost of such licensing shall be part of the base bid package.
2. The Owner shall have the right to modify, use or reproduce for his own use, any software or programming which is part of this project.

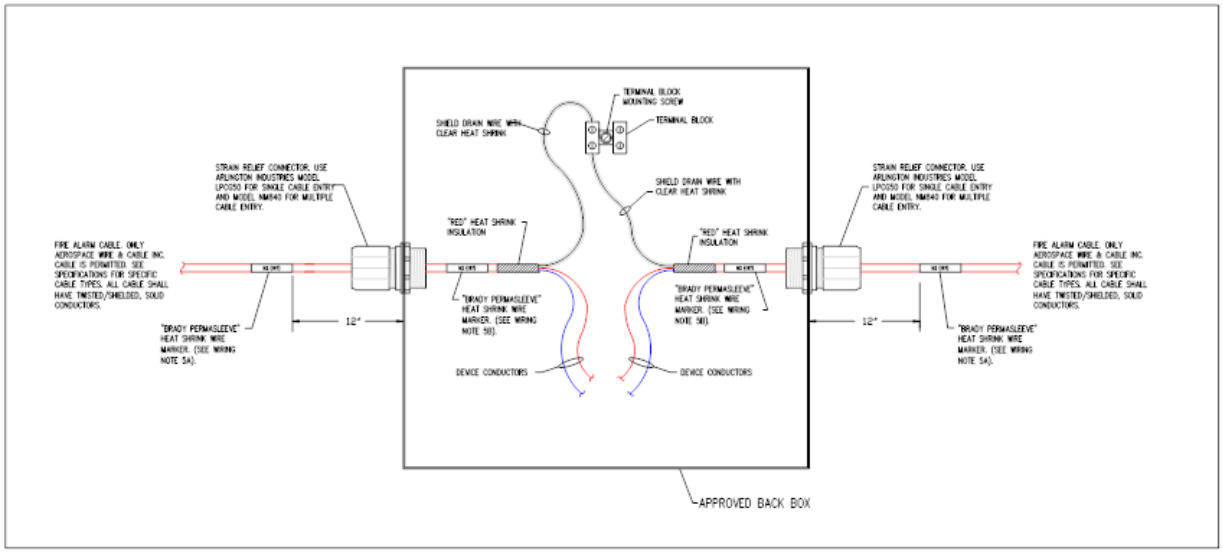
8.11 PART 7 - DETAILS

8.12 7.1 – SMOKE BAFFLE DETAIL



BAFFLE MOUNTING:
1. BAFFLES ARE TO BE INSTALLED ON THE DIFFUSER SIDE OF THE DETECTOR.
2. ALL SMOKE DETECTORS THAT ARE WITHIN 6 FEET OF AN AIR DIFFUSER ARE REQUIRED TO HAVE BAFFLES.
3. BAFFLES ARE TO BE INSTALLED 8" AWAY FROM SIDE OF DETECTORS.
4. BAFFLES ARE PREFABRICATED WITH 1/4" PLEXIGLASS. 8" WIDE BY 4" DEEP.
5. BAFFLES ARE TO BE BOLTED TO CEILING TILE. FINAL INSTALLATION METHOD TO BE DETERMINED BY OWNER.
6. CONTRACTOR TO PROVIDE UNIT PRICE FOR BAFFLES. FINAL QUANTITY WILL BE DETERMINED BY ACTUAL INSTALLATION. UNIT PRICE TO INCLUDE COST FOR MATERIAL AND INSTALLATION.

8.13 7.2 - SHIELD, WIRE LABEL AND BACK BOX DETAIL



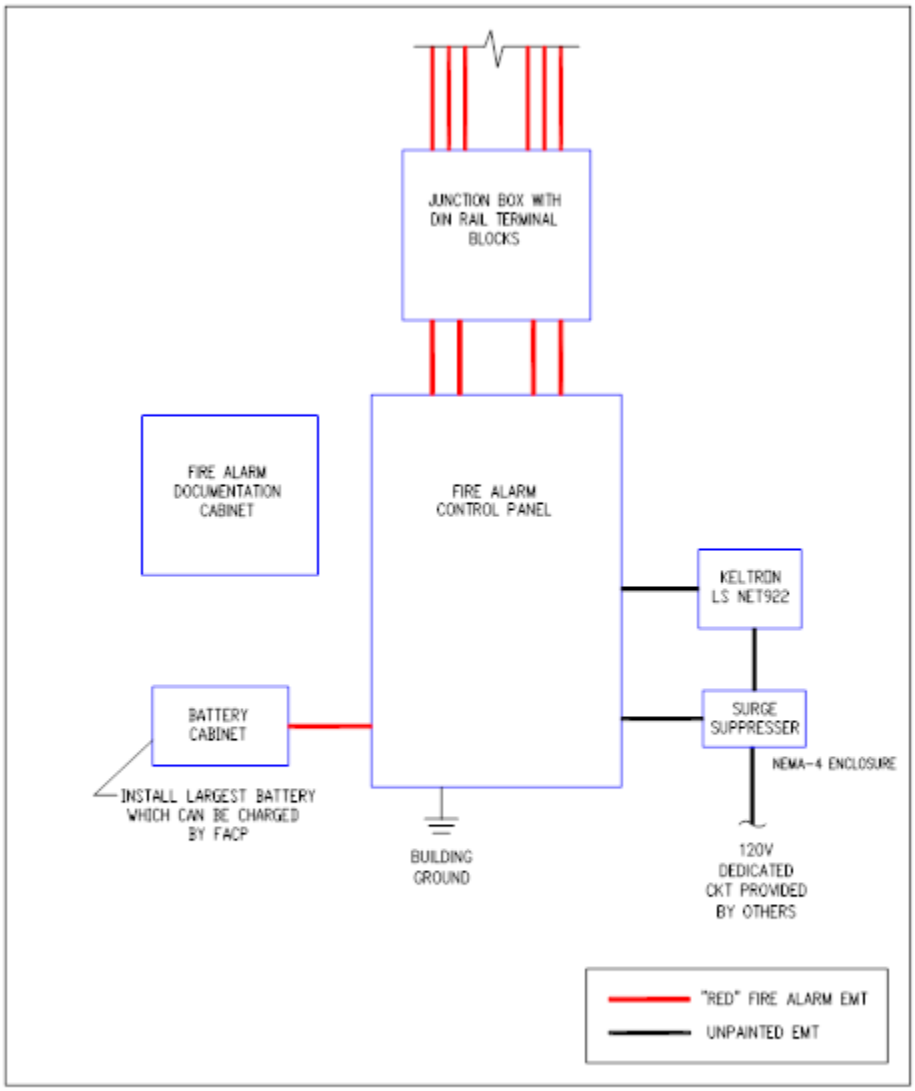
FIRE ALARM WIRING DETAILS

SCALE: NTS

WIRING DETAIL NOTES:

1. ALL FIRE ALARM & DETECTION DEVICES SHALL BE SECURELY MOUNTED USING APPROVED BACK BOXES. ONLY APPROVED AND APPROPRIATE TYPES OF CONDUIT AND CABLE CONNECTORS SHALL BE USED FOR CONNECTIONS TO BACK BOXES.
2. ALL WIRE/CABLE INSTALLATION AND WIRE/CABLE TYPES SHALL BE IN ACCORDANCE WITH THE FIRE ALARM PROJECT SPECIFICATIONS. CONTRACTOR SHALL SUBMIT 12 INCH WIRE SAMPLES AT TIME OF SHOP DRAWING SUBMITTALS FOR APPROVAL PRIOR TO MATERIAL PURCHASE.
3. ALL WIRE/CABLE USED FOR INITIATING, SIGNAL AND COMMUNICATION CIRCUITS SHALL BE AS MANUFACTURED BY AEROSPACE WIRE & CABLE INC., AS LISTED IN THE PROJECT SPECIFICATIONS AND AS FOLLOWS:
   A. USE MINIMUM SIZE OF 18 AWG TWISTED/SHIELDED, SOLID CONDUCTORS FOR ALL INITIATING DEVICE CIRCUITS.
   B. USE MINIMUM SIZE OF 14 AWG TWISTED/SHIELDED, SOLID CONDUCTORS FOR ALL SIGNAL (AUDIO/VISUAL) DEVICE CIRCUITS.
   C. USE MINIMUM SIZE OF 18 AWG TWISTED/SHIELDED, SOLID CONDUCTORS FOR ALL COMMUNICATION BUS CIRCUITS.
4. ALL WIRE/CABLE STRAIN RELIEF FROM BACK BOXES, DEVICE JUNCTIONS AND PANEL BOXES SHALL CONSIST OF CONNECTORS AS LISTED IN THE SPECIFICATIONS AND AS SHOWN ON THE WIRING DETAIL ABOVE.
5. EACH CONDUCTOR SHALL HAVE A UNIQUE AND DURABLE WIRE NUMBER INSTALLED AT ANY LOCATION WHERE A CONDUCTOR IS LANDED. ONLY "BRADY PERMASLEEVE" HEAT SHRINK WIRE MARKERS WILL BE PERMITTED.
   A. WHERE CONDUCTORS ARE LANDED AT A DEVICE BACK BOX INSTALLED ABOVE A SUSPENDED LAY-IN CEILING, THE WIRE MARKERS SHALL BE INSTALLED ON EACH CABLE 12 INCHES BEFORE ENTERING THE BACK BOX AND 12 INCHES AFTER EXISTING THE BACK BOX.
   B. WHERE CONDUCTORS ARE LANDED AT A DEVICE BACK BOX INSTALLED ON CONCRETE/BLOCK CEILING OR ABOVE A GYPSUM OR SPLINE CEILING, THE WIRE MARKERS SHALL BE INSTALLED ON EACH CABLE INSIDE OF THE BACK BOX AND JUST PRIOR TO THE RED HEAT SHRINK INSULATION.
6. ALL CONDUCTOR TERMINATION'S, SPLICE CONNECTIONS AND ALL OTHER CONNECTIONS SHALL BE MADE USING UL LISTED COMPRESSION TERMINAL BLOCKS AS LISTED IN THE PROJECT SPECIFICATIONS. NO WIRE NUTS OR CRIMP CONNECTION DEVICES WILL BE APPROVED.
7. ALL TERMINAL BLOCKS, CARDS, RELAYS AND OTHER DEVICES SHALL BE RIGIDLY MOUNTED WITHIN A CABINET ENCLOSURE OR BACK BOX USING SCREWS, BOLT & NUT OR APPROVED EPOXY GLUE. DOUBLE BACK TAPE OR SIMILAR MOUNTING SYSTEM WILL NOT BE PERMITTED.

8.14 7.3 FIRE ALARM PANEL DETAIL



FIRE ALARM PANEL DETAIL

SCALE: NTS

FIRE ALARM PANEL AND NAC PANEL DETAIL NOTES:

1. FIRE ALARM PANELS, CONDUIT AND EQUIPMENT DETAILS AS SHOWN ABOVE ARE FOR REFERENCE AND BID PURPOSES ONLY. CONTRACTOR SHALL FIELD COORDINATE THE LAYOUT OF PANELS AND ASSOCIATED EQUIPMENT. THE FINAL QUANTITY AND ARRANGEMENT OF THE NEW PANELS, CONDUIT AND EQUIPMENT SHALL BE BASED ON THE FIRE ALARM CONTRACTORS FINAL SYSTEM DESIGN. CONTRACTOR SHALL INDICATE THE LOCATION OF THE FACP PANEL AND ASSOCIATED EQUIPMENT ON SHOP DRAWINGS. ARRANGEMENT AND ELEVATION OF ALL PANELS, CONDUIT AND EQUIPMENT SHALL ALSO BE SHOWN ON SHOP DRAWINGS FOR APPROVAL.
2. ALL NEW FIRE ALARM SYSTEM PANELS, ASSOCIATED EQUIPMENT AND WIRING SHALL BE INSTALLED IN ACCORDANCE WITH THE FIRE ALARM PROJECT SPECIFICATIONS, MANUFACTURERS REQUIREMENTS, FM GLOBAL, NFPA 70 AND NFPA 72.
3. ALL PANEL AND/OR JUNCTION BOX WIRE CONNECTIONS SHALL USE "SQUARE D" MODEL 9080 GM6 TERMINAL BLOCKS, 600 V, 30A WITH DIN RAIL OR APPROVED EQUAL.
4. NAC PANEL DETAIL AS SHOWN ON THIS DRAWING IS INCLUDED FOR PROJECTS/BUILDINGS WHERE ADDITIONAL NAC PANELS ARE REQUIRED BASED ON THE CONTRACTORS DESIGN. INSTALL NAC PANELS IN ACCORDANCE WITH DETAILS, FIRE ALARM SPECIFICATIONS AND MANUFACTURER REQUIREMENTS.
5. NEW FIRE ALARM PANELS, EQUIPMENT AND CONDUIT AS SHOWN IN DETAILS SHALL BE SURFACE MOUNTED WHERE INSTALLED ON ON BLOCK WALLS. ALL NEW FIRE ALARM SYSTEM PANELS, CONDUIT AND EQUIPMENT SHALL BE INSTALLED WHERE THEY WILL NOT BE SUBJECT TO DAMAGE, ARE EASILY ACCESSIBLE AND WHERE THEY WILL NOT OBSTRUCT NORMAL BUILDING OPERATIONS. COORDINATE ALL INSTALLATION WORK WITH THE PROJECT MANAGER AND UD ELECTRIC SHOP.

8.15 PART 8 – BIDDING FORM C

8.16 8.1 FORM "C" - THIS IS A SAMPLE FORM TO BE USED BY THE BIDDER.

8.17 PROPOSAL FORM "C"

8.18 PROJECT NAME: _____ - FIRE ALARM

8.19 MANUFACTURER'S SYSTEM NAME - (SIMPLEX – SIEMENS – NOTIFIER –)

8.20 SECTION 00003 - PROPOSAL FORM

8.21 THE CONTRACTOR SHALL SUBMIT HIS QUOTE FOR CONSTRUCTION IN DUPLICATE ON HIS LETTERHEAD EXACTLY IN THE FOLLOWING FORM. UNIT PRICES MUST INCLUDE CHARGES, INCLUDING INSTALLATION AND ALL OVERHEAD AND PROFIT. NO OTHER FORM OF PRICE SUBMISSION WILL BE APPROVED. BID SUBMISSIONS NOT SUBMITTED IN THIS FORMAT WILL BE REJECTED WITHOUT REVIEW OR CAUSE.

8.22 ROWAN UNIVERSITY

8.23 ATTENTION: _____

8.24 GENTLEMEN:

8.25 HAVING CAREFULLY EXAMINED THE PROJECT SPECIFICATIONS, THE BID DRAWINGS AND ALL ADDENDA ISSUED DURING THE BIDDING PERIOD, AS WELL AS THE PREMISES AND CONDITIONS AFFECTING THE WORK, THE UNDERSIGNED PROPOSES TO FURNISH ALL MATERIALS AND LABOR

FOR THE FIRE ALARM SYSTEMS IN ACCORDANCE WITH THESE DOCUMENTS FOR THE SUMS ITEMIZED BELOW:

8.26 PROVIDE DESCRIPTION OF PROPOSED FIRE ALARM EQUIPMENT AS FOLLOWS:

8.27 8.2 BASE BID

8.28 8.2.1 FIRE ALARM EQUIPMENT ----------

8.29 BRIEF DESCRIPTION WITH MANUFACTURER NAME, TYPE, STYLE, AND MINIMAL CUT SHEET INFORMATION.

8.30 8.2.2 FIRE DETECTION AND ALARM EQUIPMENT ----------

8.31 BRIEF DESCRIPTION WITH MANUFACTURER NAME, TYPE, STYLE AND MINIMAL CUT SHEET INFORMATION. INCLUDE SMOKE DETECTORS, HEAT DETECTORS, MANUAL PULL

STATIONS, AUDIO DEVICES, VISUAL DEVICES, CONDUIT AND SURFACE CONDUIT TYPES, WATERTIGHT JUNCTION BOXES AND DAC SYSTEM INTERFACE EQUIPMENT.

8.32 UNIT PRICING ----------

8.33 PROVIDE "UNIT PRICE" AND "DEDUCT CREDIT" FOR "INSTALLED EQUIPMENT" BEYOND THE SCOPE OF MATERIALS LISTED IN THE SPECIFICATION AS FOLLOWS:

8.34 DEVICE/COMPONENT UNIT DEDUCT

8.35 ----------

8.36 MANUAL PULL STATIONS ----------

8.37 MONITOR ZAMS ----------

8.38 CONTROL ZAMS ----------

8.39 SMOKE DETECTORS ----------

8.40 DUCT SMOKE DETECTORS ----------

8.41 BEAM SMOKE DETECTORS ----------

8.42 HEAT DETECTORS ----------

8.43 HORNS ----------

8.44 STROBES -15 CD ----------

8.45 HORN/STROBES -15 CD ----------

8.46 HORN/STROBES - 30 CD ----------

8.47 HORN/STROBES - 75 CD ----------

8.48 HORN/STROBES - 110 CD ----------

8.49 SURGE PROTECTORS ----------

8.50 DIGITAL ALARM COMMUNICATORS ----------

8.51 SIGNAL CIRCUITS ----------

8.52 AUDIO CIRCUITS ----------

8.53 REMOTE LCD ANNUNCIATORS ----------

8.54 SMOKE DETECTOR RELOCATES ----------

8.55 CONDUIT PER 100 FEET INSTALLED --------

8.56 WIRING PER 100 FEET INSTALLED ---------

8.57 NA

8.58 8.2.5 EXCEPTIONS ----------

8.59 EXCEPTIONS, CHANGES, OR MODIFICATIONS TO THE BID DOCUMENTS AND FORM "C".

8.60 EXCEPTION #1, EXCEPTION #2, ETC.

8.61 8.2.6 NA

8.62 8.2.7 NA

8.63 8.2.8 WORK PROGRESS AND MANPOWER SCHEDULE ----------

8.64 PROVIDE A SCHEDULE BY WEEK THROUGH COMPLETION INDICATING THE FOLLOWING:

8.65 IMPORTANT NOTE: A SIGNIFICANT PORTION OF THE DECISION PROCESS FOR A SUCCESSFUL BIDDER WILL BE BASED UPON THE BIDDER'S ABILITY TO COMPLETE THE WORK ON TIME. THE

SCHEDULE REQUESTED WILL BE USED TO MAKE THAT DETERMINATION. PLEASE TAKE THE TIME TO WORK THROUGH THE SCHEDULE CAREFULLY AND COMPLETELY. INCOMPLETE INFORMATION IS AN INDICATION OF THE POTENTIAL QUALITY OF WORK AND CAPABILITY OF THE CONTRACTOR.

A. Manpower assigned and working on the project by week. Manpower shall include all subcontractors by subcontractor's name.
B. Submittals
C. Shop drawing submittals
D. Shop drawing corrections
E. Equipment order
F. Equipment delivery dates "on site"
G. Wiring installation by week
H. Equipment and device installation by week
I. Installation testing - type of testing by week - Include debug testing in this schedule
J. Acceptance testing - type of testing by week
K. As-built documentation - by week
L. Final acceptance day

8.66 NICET LEVEL IV ----------

8.67 LIST NAME AND NICET CERTIFICATION NUMBER OF THE PERSON ASSIGNED TO THE PROJECT IN ACCORDANCE WITH THE SPECIFICATIONS.

8.68 8.2.10 PROJECT MANAGER ----------

8.69 LIST NAME AND EXPERIENCE LEVEL OF THE PROJECT MANAGER ASSIGNED TO THE PROJECT IN ACCORDANCE WITH SPECIFICATIONS.

8.70 8.2.11 SUBCONTRACTORS ----------

8.71 LIST BELOW ALL SUBCONTRACTORS, THEIR ADDRESSES AND SCOPE OF WORK.

8.72 (INSERT IN NUMERICAL ORDER ALL SUBCONTRACTORS AND REQUIRED INFORMATION.)

8.73 8.2.12 NA

8.74 8.2.13 NA

8.75 8.2.14 NA

8.76 RESPECTFULLY SUBMITTED,

8.77 DATE:

8.78 ATTACHMENTS: LIST ALL ATTACHMENTS)

8.79 BASE BID/BASIS OF DESIGN WHERE SPECIFIC ITEM.

END OF SECTION

SECTION 311000 - SITE CLEARING

GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Stripping and stockpiling rock.
6. Removing above- and below-grade site improvements.
7. Disconnecting, capping or sealing, and abandoning site utilities in place.
8. Temporary erosion and sedimentation control.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for temporary erosion- and sedimentation-control measures.

C. Related Requirements:

1. Section 01500 "Temporary Facilities and Controls" for temporary erosion- and sedimentation-control measures.

1.3 DEFINITIONS

A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil," but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow.

D. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects larger than 2 inches in diameter; and free of weeds, roots, toxic materials, or other nonsoil materials.

E. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.

F. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and indicated according to requirements in Section 015639 "Temporary Tree and Plant Protection.

G. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Wilson Hall.

1.5 MATERIAL OWNERSHIP

A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.6 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.

1. Use sufficiently detailed photographs or video recordings.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plant designated to remain.

B. Topsoil stripping and stockpiling program.

C. Rock stockpiling program.

D. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

E. Burning: Documentation of compliance with burning requirements and permitting of authorities having jurisdiction. Identify location(s) and conditions under which burning will be performed.

1.7 QUALITY ASSURANCE

A. Topsoil Stripping and Stockpiling Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work. Include dimensioned diagrams for placement and protection of stockpiles.

B. Rock Stockpiling Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work. Include dimensioned diagrams for placement and protection of stockpiles.

1.8 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed trafficways if required by Owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Architect.

C. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises as instructed during the pre-construction meeting.

D. Utility Locator Service: Notify New Jersey One Call or area where Project is located before site clearing.

E. Do not commence site clearing operations until temporary erosion- and sedimentation-control plant-protection measures are in place.

F. Tree- and Plant-Protection Zones: Protect according to requirements in Section 015639 "Temporary Tree and Plant Protection."

G. Soil Stripping, Handling, and Stockpiling: Perform only when the soil is dry or slightly moist.

PRODUCTS

1.9 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving."

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

B. Antirust Coating: Fast-curing, lead- and chromate-free, self-curing, universal modified-alkyd primer complying with MPI #23 (surface-tolerant, anticorrosive metal primer) or SSPC-Paint 20 or SSPC-Paint 29 zinc-rich coating.

EXECUTION

1.10 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Verify that trees, shrubs, and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified and enclosed according to requirements in Section 015639 "Temporary Tree and Plant Protection."

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

1.11 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.

1.12 TREE AND PLANT PROTECTION

A. Protect trees and plants remaining on-site according to requirements in Section 015639 "Temporary Tree and Plant Protection."

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations according to requirements in Section 015639 "Temporary Tree and Plant Protection."

1.13 EXISTING UTILITIES

A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.

1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. Locate, identify, disconnect, and seal or cap utilities indicated to be abandoned in place.

1. Arrange with utility companies to shut off indicated utilities.
2. Owner will arrange to shut off indicated utilities when requested by Contractor.

C. Locate, identify, and disconnect utilities indicated to be abandoned in place.

D. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect not less than three days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

E. Excavate for and remove underground utilities indicated to be removed.

F. Removal of underground utilities is included in earthwork sections; in applicable fire suppression, plumbing, HVAC, electrical, communications, electronic safety and security, and utilities sections; and in Section 024116 "Structure Demolition" and Section 024119 "Selective Demolition."

1.14 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Grind down stumps and remove roots larger than 2 inches in diameter, obstructions, and debris to a depth of 18 inches exposed subgrade.
3. Use only hand methods or air spade for grubbing within protection zones.
4. Chip removed tree branches and stockpile in areas approved by Architect.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches and compact each layer to a density equal to adjacent original ground.

1.15 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

1. Limit height of topsoil stockpiles to 72 inches
2. Do not stockpile topsoil within protection zones.
3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
4. Stockpile surplus topsoil to allow for respreading deeper topsoil.

1.16 STOCKPILING ROCK

A. Remove from construction area naturally formed rocks that measure more than 1 foot across in least dimension. Do not include excavated or crushed rock.

1. Separate or wash off non-rock materials from rocks, including soil, clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

B. Stockpile rock away from edge of excavations without intermixing with other materials. Cover to prevent windblown debris from accumulating among rocks.

1. Limit height of rock stockpiles to 36 inches
2. Do not stockpile rock within protection zones.
3. Dispose of surplus rock. Surplus rock is that which exceeds quantity indicated to be stockpiled or reused.
4. Stockpile surplus rock to allow later use by the Owner.

1.17 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

1.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Burning tree, shrub, and other vegetation waste is permitted according to burning requirements and permitting of authorities having jurisdiction. Control such burning to produce the least smoke or air pollutants and minimum annoyance to surrounding properties. Burning of other waste and debris is prohibited.

C. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials, and transport them to recycling facilities. Do not interfere with other Project work.

PART 2 - END OF SECTION 311000

SECTION 312000 – EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Excavating and filling for rough grading the Site.
2. Preparing subgrades for slabs-on-grade, walks and plants.
3. Excavating and backfilling for buildings and structures.
4. Drainage course for concrete slabs-on-grade.
5. Subbase course for concrete walks.
6. Subbase course and base course for asphalt paving.
7. Subsurface drainage backfill for walls and trenches.
8. Excavating and backfilling trenches for utilities and pits for buried utility structures.
9. Excavating well hole to accommodate elevator-cylinder assembly.

B. Related Requirements:

1. [Section 013200 "Construction Progress Documentation"] [Section 013233 "Photographic Documentation"] for recording pre-excavation and earth-moving progress.
2. Section 311000 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
3. Section 315000 "Excavation Support and Protection" for shoring, bracing, and sheet piling of excavations.
4. Section 329300 "Plants" for finish grading in planting areas and tree and shrub pit excavation and planting.

1.3 UNIT PRICES

A. Work of this Section is affected by unit prices for earth moving specified in Section 012200 "Unit Prices."

B. Quantity allowances for earth moving are included in Section 012100 "Allowances."

C. Rock Measurement: Volume of rock actually removed, measured in original position, but not to exceed the following. Unit prices for rock excavation include replacement with approved materials.

1. 24 inches outside of concrete forms other than at footings.
2. 12 inches outside of concrete forms at footings.
3. 6 inches outside of minimum required dimensions of concrete cast against grade.
4. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
5. 6 inches beneath bottom of concrete slabs-on-grade.
6. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

1.4 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices
2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed1 cu. yd. for bulk excavation or 3/4 cu. yd. for footing, trench, and

pit excavation that cannot be removed by rock-excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:

1. Equipment for Footing, Trench, and Pit Excavation: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch maximum-width, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,700 lbf and stick-crowd force of not less than 18,400 lbf with extra-long reach boom.
2. Equipment for Bulk Excavation: Late-model, track-mounted loader; rated at not less than 230-hp flywheel power and developing a minimum of 47,992-lbf breakout force with a general-purpose bare bucket.

I. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by a geotechnical testing agency, according to ASTM D1586.

J. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

K. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

L. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

M. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct pre-excavation conference at Wilson Hall.

1. Review methods and procedures related to earthmoving, including, but not limited to, the following:

   a. Personnel and equipment needed to make progress and avoid delays.
   b. Coordination of Work with utility locator service.
   c. Coordination of Work and equipment movement with the locations of tree- and plant-protection zones.
   d. Extent of trenching by hand or with air spade.
   e. Field quality control.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of the following manufactured products required:

1. Geotextiles.
2. Controlled low-strength material, including design mixture.
3. Geofoam.
4. Warning tapes.

B. Samples for Verification: For the following products, in sizes indicated below:

1. Geotextile: 12 by 12 inches
2. Warning Tape: 12 inches long; of each color.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:

1. Classification according to ASTM D2487.
2. Laboratory compaction curve according to ASTM D698.*

C. Blasting plan[approved by authorities having jurisdiction.

D. Seismic survey report from seismic survey agency.

E. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth-moving operations. Submit before earth moving begins.

1.8 QUALITY ASSURANCE

A. Blasting: Comply with applicable requirements in NFPA 495, "Explosive Materials Code," and prepare a blasting plan reporting the following:

1. Types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
2. Seismographic monitoring during blasting operations.

B. Seismic Survey Agency: An independent testing agency, acceptable to authorities having jurisdiction, experienced in seismic surveys and blasting procedures to perform the following services:

1. Report types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
2. Seismographic monitoring during blasting operations.

C. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E329 and ASTM D3740 for testing indicated.

1.9 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Architect.

C. Utility Locator Service: Notify New Jersey One Call for area where Project is located before beginning earth-moving operations.

D. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures specified in Section 311000 "Site Clearing are in place.

E. Do not commence earth-moving operations until plant-protection measures specified in Section 015639 "Temporary Tree and Plant Protection" are in place.

F. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

G. Do not direct vehicle or equipment exhaust towards protection zones.

H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D2487 or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter. See soils report for:

1. Liquid Limit:
2. Plasticity Index:

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D2487 Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7 according to AASHTO M 145 or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 95 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

H. Drainage Course: Narrowly graded mixture of[washed crushed stone, or crushed or uncrushed gravel; ASTM D448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and zero to 5 percent passing a No. 8 (2.36-mm) sieve.

I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch (25-mm) sieve and zero to 5 percent passing a No. 4 (4.75-mm) sieve.

J. Sand: ASTM C33/C33M; fine aggregate.

K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 GEOTEXTILES

A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Survivability: As follows:

    a. Grab Tensile Strength: 157 lbf; ASTM D4632.
    b. Sewn Seam Strength: 142 lbf ; ASTM D4632.
    c. Tear Strength: 56 lbf ; ASTM D4533.
    d. Puncture Strength: 56 lbf ; ASTM D4833.

3. Apparent Opening Size: [No. 40 (0.425-mm)] [No. 60 (0.250-mm)] [No. 70 (0.212-mm)] sieve, maximum; ASTM D4751.
4. Permittivity:[0.5 per second, minimum; ASTM D4491.
5. UV Stability: 50 percent after 500 hours' exposure; ASTM D4355.

B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Survivability: As follows:

    a. Grab Tensile Strength: 247 lbf; ASTM D4632.
    b. Sewn Seam Strength: 222 lbf; ASTM D4632.
    c. Tear Strength: 90 lbf ; ASTM D4533.
    d. Puncture Strength: 90 lbf ASTM D4833.

3. Apparent Opening Size: No. 60 sieve, maximum; ASTM D4751.
4. Permittivity: 0.02 per second, minimum; ASTM D4491.
5. UV Stability: 50 percent after 500 hours' exposure; ASTM D4355.

2.3 CONTROLLED LOW-STRENGTH MATERIAL

A. Controlled Low-Strength Material: Self-compacting[**, low-density**], flowable concrete material produced from the following:

1. Portland Cement: ASTM C150/C150M, Type I, Type II or Type III.
2. Fly Ash: ASTM C618, Class C or F.
3. Normal-Weight Aggregate: ASTM C33/C33M, 3/4-inch (19-mm) nominal maximum aggregate size.
4. Foaming Agent: ASTM C869/C869M.
5. Water: ASTM C94/C94M.
6. Air-Entraining Admixture: ASTM C260/C260M.

B. Produce low-density, controlled low-strength material with the following physical properties:

1. As-Cast Unit Weight: [36 to 42 lb/cu. ft. (576 to 675 kg/cu. **M** at point of placement, when tested according to ASTM C138/C138M.
2. Compressive Strength: 80 psi when tested according to ASTM C495/C495M.

C. Produce conventional-weight, controlled low-strength material with 80-psi (550-kPa) compressive strength when tested according to ASTM C495/C495M.

2.4 GEOFOAM

A. Extruded-Polystyrene Board Insulation: ASTM C578, [Type IV, 1.55-lb/cu. ft. (25-kg/cu. m) density, 25-psi (173-kPa) compressive strength] [Type X, 1.30-lb/cu. ft. (21-kg/cu. m) density, 15-psi (104-kPa) compressive strength] [Type VI, 1.80-lb/cu. ft. (29-kg/cu. m) density, 40-psi (276-kPa) compressive strength] [Type VII, 2.20-lb/cu. ft. (35-kg/cu. m) density, 60-psi (414-kPa) compressive strength] [Type V, 3.00-lb/cu. ft. (48-kg/cu. m) density, 100-psi (690-kPa) compressive strength.

B. Molded-Polystyrene Board Insulation: ASTM C578, [Type I, 0.90-lb/cu. ft. (15-kg/cu. m) density, 10-psi (69-kPa) compressive strength] [Type VIII, 1.15-lb/cu. ft. (18-kg/cu. m) density, 13-psi (90-kPa) compressive strength] [Type II, 1.35-lb/cu. ft. (22-kg/cu. m) density, 15-psi (104-kPa) compressive strength].

1. Manufacture molded polystyrene with an inorganic mineral registered with the EPA and suitable for application as a termite deterrent.

C. Rigid Cellular Polystyrene Geofoam: ASTM D6817, [Type EPS 19, 1.15-lb/cu. ft. (18.4-kg/cu. m) density, 5.8-psi (40-kPa) compressive strength at 1 percent deformation; 16-psi (110-kPa) compressive strength at 10 percent deformation] [Type EPS 39, 2.40-lb/cu. ft. (38.4-kg/cu. m) density, 15-psi (103-kPa) compressive strength at 1 percent deformation; 40-psi (276-kPa) compressive strength at 10 percent deformation]

D. Connectors: Geofoam manufacturer's multibarbed, galvanized-steel sheet connectors] [Deformed steel reinforcing bars, 3/4 inch diameter]

2.5 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.

B. Protect and maintain erosion and sedimentation controls during earth-moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Provide dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.

B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

C. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

D. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

B. Explosives: Obtain written permission from authorities having jurisdiction before bringing explosives to Project site or using explosives on Project site.

1. Perform blasting without damaging adjacent structures, property, or site improvements.
2. Perform blasting without weakening the bearing capacity of rock subgrade and with the least-practicable disturbance to rock to remain.

3.4 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:

a. 24 inches outside of concrete forms other than at footings.
b. 12 inches of concrete forms at footings.
c. 6 inches > outside of minimum required dimensions of concrete cast against grade.
d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
e. 6 inches beneath bottom of concrete slabs-on-grade.
f. 6 inches beneath pipe in trenches and the greater of 24 inches wider than pipe or 42 inches

B. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Architect. The Contract Sum will be adjusted for rock excavation according to unit prices included in the Contract Documents. Changes in the Contract Time may be authorized for rock excavation.

1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; and soil, boulders, and other materials not classified as rock or unauthorized excavation.

    a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.

2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:

    a. 24 inches outside of concrete forms other than at footings.
    b. 12 inches outside of concrete forms at footings.
    c. 6 inches outside of minimum required dimensions of concrete cast against grade.
    d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
    e. 6 inches bottom of concrete slabs-on-grade.
    f. 6 inches beneath pipe in trenches and the greater of [24 inches > wider than pipe or 42 inches wide.

3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

B. Excavations at Edges of Tree- and Plant-Protection Zones:

1. Excavate by hand or with an air spade to indicated lines, cross sections, elevations, and subgrades. If excavating by hand, use narrow-tine spading forks to comb soil and expose

roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.

2. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: [12 inches (300 mm) each side of pipe or conduit.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. For pipes and conduit less than 6 inches in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
4. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

E. Trenches in Tree- and Plant-Protection Zones:

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
3. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.8 EXCAVATION FOR ELEVATOR CYLINDER – N/A

A. Drill well hole plumb in elevator pit to accommodate installation of elevator-cylinder assembly. Coordinate with applicable requirements for diameter and tolerances in [Section 142400 "Hydraulic Elevators."] [Section 142413 "Hydraulic Freight Elevators."]

B. Provide well casing as necessary to retain walls of well hole.

3.9 SUBGRADE INSPECTION

A. Notify Architect when excavations have reached required subgrade.

B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction[, repeating proof-rolling in direction perpendicular to first direction]. Limit vehicle speed to 3 mph
2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.10 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi may be used when approved by Architect.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

3.11 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.12 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring, bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.13 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 033000 "Cast-in-Place Concrete."

D. Trenches under Roadways: Provide 4-inch- thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase course. Concrete is specified in Section 033000 "Cast-in-Place Concrete."

E. Backfill voids with satisfactory soil while removing shoring and bracing.

F. Initial Backfill:

1. Soil Backfill: Place and compact initial backfill of subbase material (satisfactory soil), free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.

   a. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

2. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches over the pipe or conduit. Coordinate backfilling with utilities testing.

G. Final Backfill:

1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.
2. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.

H. Warning Tape: Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.14 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.
5. Under footings and foundations, use engineered fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.15 GEOFOAM FILL

A. Place a leveling course of sand, [2 inches, over subgrade. Finish leveling course to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

1. Place leveling course on subgrades free of mud, frost, snow, or ice.

B. Install geofoam blocks in layers with abutting edges and ends and with the long dimension of each block at right angles to blocks in each subsequent layer. Offset joints of blocks in successive layers.

C. Install geofoam connectors at each layer of geofoam to resist horizontal displacement according to geofoam manufacturer's written instructions.

D. Cover geofoam with subdrainage / separation geotextile before placing overlying soil materials.

3.16 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.17 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to [ASTM D698] [ASTM D1557]:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill soil material at 95 percent.
2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent.
3. Under turf or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 85 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

3.18 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:

1. Turf or Unpaved Areas: Plus or minus 1 inch .
2. Walks: Plus or minus 1 inch
3. Pavements: Plus or minus 1/2 inch

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.19 SUBSURFACE DRAINAGE

A. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place *a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.*

1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D698 with a minimum of two passes of a plate-type vibratory compactor.

B. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade, in compacted layers 6 inches thick. Overlay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches.

1. Compact each filter material layer [to 85 percent of maximum dry unit weight according to ASTM D698 with a minimum of two passes of a plate-type vibratory compactor.
2. Place and compact impervious fill over drainage backfill in 6-inch- thick compacted layers to final subgrade.

3.20 *SUBBASE AND BASE COURSES* UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:

1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place base course material over subbase course under hot-mix asphalt pavement.
3. Shape subbase course and base course to required crown elevations and cross-slope grades.
4. Place subbase course and base course 6 inches or less in compacted thickness in a single layer.
5. Place subbase course[and base course] that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
6. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to [ASTM D698] [ASTM D1557].

C. Pavement Shoulders: Place shoulders along edges of subbase course and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to [ASTM D698] [ASTM D1557].

3.21 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place drainage course 6 inches or less in compacted thickness in a single layer.
3. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D698.

3.22 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Determine prior to placement of fill that site has been prepared in compliance with requirements.

2. Determine that fill material classification and maximum lift thickness comply with requirements.
3. Determine, during placement and compaction, that in-place density of compacted fill complies with requirements.

B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

E. Testing agency will test compaction of soils in place according to ASTM D1556, ASTM D2167, ASTM D2937, and ASTM D6938, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab but in no case fewer than three tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length but no fewer than two tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length but no fewer than two tests.

F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.23 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.24 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

B. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.

1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000

SECTION 312319 - DEWATERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes construction dewatering.

B. Related Requirements:

1. Section 013233 "Photographic Documentation" for recording preexisting conditions and dewatering system progress.
2. Section 312000 "Earth Moving" for excavating, backfilling, site grading, and controlling surface-water runoff and ponding.

1.3 ALLOWANCES

A. Dewatering observation wells are part of dewatering allowance.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Wilson Hall.

1. Verify availability of Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review condition of site to be dewatered including coordination with temporary erosion-control measures and temporary controls and protections.
3. Review geotechnical report.
4. Review proposed site clearing and excavations.
5. Review existing utilities and subsurface conditions.
6. Review observation and monitoring of dewatering system.

1.5 ACTION SUBMITTALS

A. Shop Drawings: For dewatering system, prepared by or under the supervision of a qualified professional engineer.

1. Include plans, elevations, sections, and details.
2. Show arrangement, locations, and details of wells and well points; locations of risers, headers, filters, pumps, power units, and discharge lines; and means of discharge, control of sediment, and disposal of water.
3. Include layouts of piezometers and flow-measuring devices for monitoring performance of dewatering system.
4. Include written plan for dewatering operations including sequence of well and well-point placement coordinated with excavation shoring and bracings and control procedures to be adopted if dewatering problems arise.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, land surveyor and professional engineer.

B. Field quality-control reports.

C. Existing Conditions: Using photographs or video recordings, show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by dewatering operations. Submit before Work begins.

D. Record Drawings: Identify locations and depths of capped wells and well points and other abandoned-in-place dewatering equipment.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer that has specialized in design of dewatering systems and dewatering work.

1.8 FIELD CONDITIONS

A. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from this data.

1. Make additional test borings and conduct other exploratory operations necessary for dewatering according to the performance requirements.
2. The geotechnical report is referenced elsewhere in Project Manual.

B. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.

1. Design dewatering system, including comprehensive engineering analysis by a qualified professional engineer.
2. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, prevention of flooding in excavation, and prevention of damage to subgrades and permanent structures.
3. Prevent surface water from entering excavations by grading, dikes, or other means.
4. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.
5. Remove dewatering system when no longer required for construction.

B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with water- and debris-disposal regulations of authorities having jurisdiction.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.

1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site or surrounding area.
2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

C. Provide temporary grading to facilitate dewatering and control of surface water.

D. Protect and maintain temporary erosion and sedimentation controls, which are specified in Section 311000 "Site Clearing," during dewatering operations.

3.2 INSTALLATION

A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.

1. Space well points or wells at intervals required to provide sufficient dewatering.
2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.

B. Place dewatering system into operation to lower water to specified levels before excavating below ground-water level.

C. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

D. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails.

3.3 OPERATION

A. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.

B. Operate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.

1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.
2. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.
3. Maintain piezometric water level a minimum of 24 inches below bottom of excavation.

C. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.

D. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches below overlying construction.

3.4 FIELD QUALITY CONTROL

A. Observation Wells: Provide observation wells or piezometers, take measurements, and maintain at least the minimum number indicated; additional observation wells may be required by authorities having jurisdiction.

1. Observe and record daily elevation of ground water and piezometric water levels in observation wells.
2. Repair or replace, within 24 hours, observation wells that become inactive, damaged, or destroyed. In areas where observation wells are not functioning properly, suspend construction activities until reliable observations can be made. Add or remove water from observation-well risers to demonstrate that observation wells are functioning properly.
3. Fill observation wells, remove piezometers, and fill holes when dewatering is completed.

B. Survey-Work Benchmarks: Resurvey benchmarks regularly during dewatering and maintain an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Architect if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

C. Provide continual observation to ensure that subsurface soils are not being removed by the dewatering operation.

D. Prepare reports of observations.

3.5 PROTECTION

A. Protect and maintain dewatering system during dewatering operations.

B. Promptly repair damages to adjacent facilities caused by dewatering.

END OF SECTION 312319

SECTION 321313 - CONCRETE PAVING

PART 1 GENERAL

1. RELATED DOCUMENTS

a. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

2. SUMMARY

a. Section Includes Concrete Paving (all may not be applicable to this project)

1) Driveways.
2) Roadways.
3) Parking lots.
4) Curbs and gutters.
5) Walks.

b. Related Requirements:

1) Section 033000 Cast-in-Place Concrete for general building applications of concrete.
2) Section 321316 "Decorative Concrete Paving" for stamped concrete other than stamped detectable warnings.
3) Section 321373 "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving and in joints between concrete paving and asphalt paving or adjacent construction.

3. DEFINITIONS

a. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.

b. W/C Ratio: The ratio by weight of water to cementitious materials.

4. PREINSTALLATION MEETINGS

a. Preinstallation Conference: Conduct conference at Wilson Hall.

1) Review methods and procedures related to concrete paving, including but not limited to, the following:

   a) Concrete mixture design.
   b) Quality control of concrete materials and concrete paving construction practices.

2) Require representatives of each entity directly concerned with concrete paving to attend, including the following:

   a) Contractor's superintendent.
   b) Independent testing agency responsible for concrete design mixtures.
   c) Ready-mix concrete manufacturer.
   d) Concrete paving Subcontractor.
   e) Manufacturer's representative of stamped concrete paving system used for stamped detectable warnings.

5. ACTION SUBMITTALS

a. Product Data: For each type of product.

b. Sustainable Design Submittals:

   1) See Project Drawings

c. Samples for Initial Selection: For each type of product, ingredient, or admixture requiring color selection.

d. Samples for Verification: For each type of product or exposed finish, prepared as Samples of size indicated below:

   1) Exposed Aggregate: 10-lb Sample of each mix.

e. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

6. INFORMATIONAL SUBMITTALS

a. Qualification Data: For qualified Installer of stamped detectable warnings ready-mix concrete manufacturer and testing agency.

b. Material Certificates: For the following, from manufacturer:

   1) Cementitious materials.

2) Steel reinforcement and reinforcement accessories.
3) Fiber reinforcement.
4) Admixtures.
5) Curing compounds.
6) Applied finish materials.
7) Bonding agent or epoxy adhesive.
8) Joint fillers.

c. Material Test Reports: For each of the following:

1) Aggregates: Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

d. Field quality-control reports.

7. QUALITY ASSURANCE

a. Stamped Detectable Warning Installer Qualifications: An employer of workers trained and approved by manufacturer of stamped concrete paving systems.

b. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1) Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

c. Testing Agency Qualifications: Qualified according to ASTM C1077 and ASTM E329 for testing indicated.

1) Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

d. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1) Build mockups of full-thickness sections of concrete paving to demonstrate typical joints; surface finish, texture, and color; curing; and standard of workmanship.
2) Build mockups of concrete paving in the location and of the size indicated or, if not indicated, build mockups where directed by Architect and not less than 96 inches by 96 inches.
3) Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

4) Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

8. PRECONSTRUCTION TESTING

a. Preconstruction Testing Service: Engage a qualified independent testing agency to perform preconstruction testing on concrete paving mixtures.

9. FIELD CONDITIONS

a. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

b. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

1) When air temperature has fallen to or is expected to fall below 40 deg F , uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
2) Do not use frozen materials or materials containing ice or snow.
3) Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

c. Hot-Weather Concrete Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1) Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2) Cover steel reinforcement with water-soaked burlap, so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3) Fog-spray forms**,** steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

PART 2 PRODUCTS

1. CONCRETE, GENERAL

a. ACI Publications: Comply with ACI 301 unless otherwise indicated.

2. FORMS

a. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.

1) Use flexible or uniformly curved forms for curves with a radius of 100 feet or less.[Do not use notched and bent forms**.**]

b. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

3. STEEL REINFORCEMENT

a. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, fabricated from as-drawn steel wire into flat sheets.

b. Deformed-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, flat sheet.

c. Epoxy-Coated Welded-Wire Reinforcement: ASTM A884/A884M, Class A, plain steel.

d. Reinforcing Bars: ASTM A615/A615M, Grade 60; deformed.

e. Galvanized Reinforcing Bars: ASTM A767/A767M, Class II zinc coated, hot-dip galvanized after fabrication and bending; with ASTM A615/A615M, Grade 60 deformed bars.

f. Epoxy-Coated Reinforcing Bars: ASTM A775/A775M or ASTM A934/A934M; with ASTM A615/A615M, Grade 60 deformed bars.

g. Steel Bar Mats: ASTM A184/A184M; with ASTM A615/A615M, Grade 60 deformed bars; assembled with clips.

h. Plain-Steel Wire: ASTM A1064/A1064M, as drawn.

i. Deformed-Steel Wire: ASTM A1064/A1064M.

j. Epoxy-Coated-Steel Wire: ASTM A884/A884M, Class A; coated, plain.

k. Joint Dowel Bars: ASTM A615/A615M, Grade 60 plain-steel bars[**;** zinc coated (galvanized) after fabrication according to ASTM A767/A767M, Class I coating. Cut bars true to length with ends square and free of burrs.

l. Epoxy-Coated, Joint Dowel Bars: ASTM A775/A775M; with ASTM A615/A615M, Grade 60 plain-steel bars.

m. Tie Bars: ASTM A615/A615M, Grade 60; deformed.

n. Hook Bolts:(ASTM F568M, Property Class 4.6), internally and externally threaded. Design hook-bolt joint assembly to hold coupling against paving form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

o. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded-wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:

1) Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
2) For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

p. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating, compatible with epoxy coating on reinforcement.

q. Zinc Repair Material: ASTM A780/A780M.

4. CONCRETE MATERIALS

a. Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:

1) Portland Cement: ASTM C150/C150M, gray or white portland cement [Type I] [Type II] [Type I/II] [Type III] [Type V].
2) Fly Ash: ASTM C618, [Class C] [or] [Class F].
3) Slag Cement: ASTM C989/C989M, Grade 100 or 120.
4) Blended Hydraulic Cement: ASTM C595/C595M, [Type IS, portland blast-furnace slag] [Type IP, portland-pozzolan] [Type IL, Portland-limestone] [Type IT, ternary blended] cement.

b. Normal-Weight Aggregates: ASTM C33/C33M, [Class 4S] [Class 4M] [Class 1N], uniformly graded. Provide aggregates from a single source[with documented service-record data of at least 10 years' satisfactory service in similar paving applications and service conditions using similar aggregates and cementitious materials.

1) Maximum Coarse-Aggregate Size: 1 inch nominal.
2) Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

c. Exposed Aggregate: Selected, hard, and durable; washed; free of materials with deleterious reactivity to cement or that cause staining; from a single source, with gap-graded coarse aggregate as follows:

1) Aggregate Sizes: 3/4 to 1 inch nominal.
2) Aggregate Source, Shape, and Color:

d. Air-Entraining Admixture: ASTM C260/C260M.

e. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

1) Water-Reducing Admixture: ASTM C494/C494M, Type A.
2) Retarding Admixture: ASTM C494/C494M, Type B.
3) Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
4) High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5) High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
6) Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

f. Color Pigment: ASTM C979/C979M, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable,[**free of carbon black,**] nonfading, and resistant to lime and other alkalis.
1) Color: selected by Architect from manufacturer's full range.

g. Water: Potable and complying with ASTM C94/C94M.

5. FIBER REINFORCEMENT

a. Synthetic Fiber: Monofilament polypropylene fibers engineered and designed for use in decorative concrete paving, complying with ASTM C1116/C1116M, Type III, 1/2 to 1-1/2 inches long.

b. Synthetic Fiber: Fibrillated polypropylene fibers engineered and designed for use in decorative concrete paving, complying with ASTM C1116/C1116M, Type III, 1/2 to 1-1/2 inches.

6. CURING MATERIALS

a. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd.dry [or cotton mats.

b. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.

c. Water: Potable.

d. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.

e. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, dissipating.

f. White, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 2, Class B, dissipating.

7. RELATED MATERIALS

a. Joint Fillers: ASTM D1751, asphalt-saturated cellulosic fiber or ASTM D1752, cork or self-expanding cork in preformed strips.

b. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

c. Bonding Agent: ASTM C1059/C1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

d. Epoxy-Bonding Adhesive: ASTM C881/C881M, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:

1) Types I and II, nonload bearing] Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

e. Chemical Surface Retarder: Water-soluble, liquid, set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch.

f. Pigmented Mineral Dry-Shake Hardener: Factory-packaged, dry combination of portland cement, graded quartz aggregate, color pigments, and plasticizing admixture. Use color pigments that are finely ground, nonfading mineral oxides interground with cement.
1) Color: As selected by Architect from manufacturer's full range.

g. Rock Salt: Sodium chloride crystals, kiln dried, coarse gradation with 100 percent passing 3/8-inch sieve and 85 percent retained on a No. 8 sieve.

8. STAMPED DETECTABLE WARNING MATERIALS

a. Detectable Warning Stamp: Semirigid polyurethane mats with formed underside capable of imprinting detectable warning pattern on plastic concrete; perforated with a vent hole at each dome.
   1) Size of Stamp: One piece, 24 inches by 24 inches.

b. Liquid Release Agent: Manufacturer's standard, clear, evaporating formulation designed to facilitate release of stamp mats.

9. CONCRETE MIXTURES

a. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.

   1) Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
   2) When automatic machine placement is used, determine design mixtures and obtain laboratory test results that comply with or exceed requirements.

b. Cementitious Materials:Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.][Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

   1) Fly Ash or Pozzolan: 25 percent.
   2) Slag Cement: 50 percent.
   3) Combined Fly Ash or Pozzolan, and Slag Cement: 50 percent, with fly ash or pozzolan not exceeding 25 percent.

c. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

   1) Air Content: [**5-1/2**] [**4-1/2**] [**2-1/2**] percent plus or minus 1-1/2 percent for 1-1/2-inch nominal maximum aggregate size.
   2) Air Content: [**6**] [**4-1/2**] [**3**] percent plus or minus 1-1/2 percent for 1-inch nominal maximum aggregate size.
   3) Air Content: 6 percent plus or minus 1-1/2 percent for 3/4-inch nominal maximum aggregate size.

d. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

e. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

1) Use [water-reducing admixture and retarding admixture plasticizing and retarding admixture] in concrete as required for placement and workability.
2) Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

f. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd

g. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

h. Concrete Mixtures: Normal-weight concrete.

1) Compressive Strength (28 Days): 3000 psi.
2) Maximum W/C Ratio at Point of Placement: 0.50
3) Slump Limit: 4 inches plus or minus 1 inch.

10. CONCRETE MIXING

a. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M[and ASTM C1116/C1116M. Furnish batch certificates for each batch discharged and used in the Work.

1) When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F reduce mixing and delivery time to 60 minutes.

b. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1) For concrete batches of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2) For concrete batches larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
3) Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

PART 3 EXECUTION

1. EXAMINATION

   a. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

   b. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.

      1) Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
      2) Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
      3) Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Section 312000 "Earth Moving."

   c. Proceed with installation only after unsatisfactory conditions have been corrected.

2. PREPARATION

   a. Remove loose material from compacted subbase surface immediately before placing concrete.

3. EDGE FORMS AND SCREED CONSTRUCTION

   a. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

   b. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

4. STEEL REINFORCEMENT INSTALLATION

   a. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

   b. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

   c. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

d. Install welded-wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

e. Zinc-Coated Reinforcement: Use galvanized-steel wire ties to fasten zinc-coated reinforcement. Repair cut and damaged zinc coatings with zinc repair material.

f. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D3963/D3963M.

g. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

5. JOINTS

a. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

1) When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

b. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.

1) Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
2) Provide tie bars at sides of paving strips where indicated.
3) Butt Joints: Use bonding agent or epoxy-bonding adhesive at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
4) Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
5) Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

c. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.

1) Locate expansion joints at intervals of [50 feet] unless otherwise indicated.
2) Extend joint fillers full width and depth of joint.

3) Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
4) Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
5) Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6) During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

d. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows[, to match jointing of existing adjacent concrete paving:

1) Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes. [Eliminate grooving-tool marks on concrete surfaces.]

a) Tolerance: Ensure that grooved joints are within 3 inches either way from centers of dowels.

2) Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

a) Tolerance: Ensure that sawed joints are within 3 inches either way from centers of dowels.

3) Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

e. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

6. CONCRETE PLACEMENT

a. Before placing concrete, inspect and complete formwork installation[, steel reinforcement,] and items to be embedded or cast-in.

b. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.

c. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

d. Comply with ACI 301 (requirements for measuring, mixing, transporting, and placing concrete.

e. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

f. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

g. Consolidate concrete according to ACI 301 (by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

1) Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement**,** or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels and joint devices.

h. Screed paving surface with a straightedge and strike off.

i. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

j. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.

k. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.

1) Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

7. FLOAT FINISHING

a. General: Do not add water to concrete surfaces during finishing operations.

b. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1) Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
2) Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.
3) Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

8. SPECIAL FINISHES

a. Monolithic Exposed-Aggregate Finish: Expose coarse aggregate in paving surface as follows:

1) Immediately after float finishing, spray-apply chemical surface retarder to paving according to manufacturer's written instructions.
2) Cover paving surface with plastic sheeting, sealing laps with tape, and remove when ready to continue finishing operations.
3) Without dislodging aggregate, remove mortar concealing the aggregate by lightly brushing surface with a stiff, nylon-bristle broom. Do not expose more than one-third of the average diameter of the aggregate and not more than one-half of the diameter of the smallest aggregate.
4) Fine-spray surface with water and brush. Repeat cycle of water flushing and brushing until cement film is removed from aggregate surfaces to depth required.

b. Seeded Exposed-Aggregate Finish: Immediately after initial floating, spread a single layer of aggregate uniformly on paving surface. Tamp aggregate into plastic concrete and float finish to entirely embed aggregate with mortar cover of 1/16 inch.

1) Spray-apply chemical surface retarder to paving according to manufacturer's written instructions.
2) Cover paving surface with plastic sheeting, sealing laps with tape, and remove sheeting when ready to continue finishing operations.
3) Without dislodging aggregate, remove mortar concealing the aggregate by lightly brushing surface with a stiff, nylon-bristle broom. Do not expose more than one-third of the average diameter of the aggregate and not more than one-half of the diameter of the smallest aggregate.
4) Fine-spray surface with water and brush. Repeat cycle of water flushing and brushing until cement film is removed from aggregate surfaces to depth required.

c. Slip-Resistive Aggregate Finish: Before final floating, spread slip-resistive aggregate finish on paving surface according to manufacturer's written instructions and as follows:

1) Uniformly spread **i**n two applications. Tamp aggregate flush with surface using a steel trowel, but do not force below surface.

2) Uniformly distribute approximately two-thirds of slip-resistive aggregate over paving surface with mechanical spreader, allow to absorb moisture, and embed by power floating. Follow power floating with a second slip-resistive aggregate application, uniformly distributing remainder of material at right angles to first application to ensure uniform coverage, and embed by power floating.
3) Cure concrete with curing compound recommended by slip-resistive aggregate manufacturer. Apply curing compound immediately after final finishing.
4) After curing, lightly work surface with a steel-wire brush or abrasive stone and water to expose nonslip aggregate.

d. Rock-Salt Finish: After initial floating uniformly spread rock salt over paving surface at the rate of 5 lb/100 sq. ft.

1) Embed rock salt into plastic concrete with roller or magnesium float.
2) Cover paving surface with 1-mil-thick polyethylene sheet and remove sheet when concrete has hardened and seven-day curing period has elapsed.
3) After seven-day curing period, saturate concrete with water and broom-sweep surface to dissolve remaining rock salt, thereby leaving pits and holes.

e. Pigmented Mineral Dry-Shake Hardener Finish: After initial floating, apply dry-shake materials to paving surface according to manufacturer's written instructions and as follows:

1) Uniformly spread dry-shake hardener at a rate of 100 lb/100 sq. ft. unless greater amount is recommended by manufacturer to match paving color required.
2) Uniformly distribute approximately two-thirds of dry-shake hardener over the concrete surface with mechanical spreader; allow hardener to absorb moisture and embed it by power floating. Follow power floating with a second application of pigmented mineral dry-shake hardener, uniformly distributing remainder of material at right angles to first application to ensure uniform color, and embed hardener by final power floating.
3) After final power floating, apply a hand-troweled finish followed by a broom finish.
4) Cure concrete with curing compound recommended by dry-shake hardener manufacturer. Apply curing compound immediately after final finishing.

9. DETECTABLE WARNING INSTALLATION

a. Blockouts: Form blockouts in concrete for installation of detectable paving units specified in Section 321726 "Tactile Warning Surfacing."

1) Tolerance for Opening Size: Plus 1/4 inch, no minus.

b. Cast-in-Place Detectable Warning Tiles: Form blockouts in concrete for installation of tiles specified in Section 321726 "Tactile Warning Surfacing." Screed surface of concrete where tiles are to be installed to elevation, so that edges of installed tiles will be flush with surrounding

concrete paving. Embed tiles in fresh concrete to comply with Section 321726 "Tactile Warning Surfacing" immediately after screeding concrete surface.

c. Stamped Detectable Warnings: Install stamped detectable warnings as part of a continuous concrete paving placement and according to stamp-mat manufacturer's written instructions.

1) Before using stamp mats, verify that the vent holes are unobstructed.
2) Apply liquid release agent to the concrete surface and the stamp mat.
3) Stamping: After application and final floating of pigmented mineral dry-shake hardener, accurately align and place stamp mats in sequence. Uniformly load, gently vibrate, and press mats into concrete to produce imprint pattern on concrete surface. Load and tamp mats directly perpendicular to the stamp-mat surface to prevent distortion in shape of domes. Press and tamp until mortar begins to come through all of the vent holes. Gently remove stamp mats.
4) Trimming: After 24 hours, cut off the tips of mortar formed by the vent holes.
5) Remove residual release agent according to manufacturer's written instructions, but no fewer than three days after stamping concrete. High-pressure-wash surface and joint patterns, taking care not to damage stamped concrete. Control, collect, and legally dispose of runoff.

10. CONCRETE PROTECTION AND CURING

a. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

b. Comply with ACI 306.1 for cold-weather protection.

c. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

d. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

e. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing curing compound or a combination of these as follows:

1) Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

a) Water.
b) Continuous water-fog spray.
c) Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period, using cover material and waterproof tape.
3) Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

11. PAVING TOLERANCES

a. Comply with tolerances in ACI 117 and as follows:

1) Elevation: 3/4 inch.
2) Thickness: Plus 3/8 inch minus 1/4 inch.
3) Surface: Gap below 10-feet-long; unleveled straightedge not to exceed 1/2 inch.
4) Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.
5) Lateral Alignment and Spacing of Dowels: 1 inch.
6) Vertical Alignment of Dowels: 1/4 inch.
7) Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
8) Joint Spacing: 3 inches.
9) Contraction Joint Depth: Plus 1/4 inch, no minus.
10) Joint Width: Plus 1/8 inch, no minus.

12. FIELD QUALITY CONTROL

a. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

b. Testing Services: Testing and inspecting of composite samples of fresh concrete obtained according to ASTM C172/C172M shall be performed according to the following requirements:

1) Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or 5000 sq. ft. or fraction thereof of each concrete mixture placed each day.

a) When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2) Slump: ASTM C143/C143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

3) Air Content: ASTM C231/C231M, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4) Concrete Temperature: ASTM C1064/C1064M; one test hourly when air temperature is 40 deg F) and below and when it is 80 deg F and above, and one test for each composite sample.
5) Compression Test Specimens: ASTM C31/C31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6) Compressive-Strength Tests: ASTM C39/C39M; test one specimen at seven days and two specimens at 28 days.

a) A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

c. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

d. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

e. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

f. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

g. Concrete paving will be considered defective if it does not pass tests and inspections.

h. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

i. Prepare test and inspection reports.

13. REPAIR AND PROTECTION

a. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

b. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

c. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

d. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313

SECTION 321316 - DECORATIVE CONCRETE PAVING

PART 1 GENERAL

1. RELATED DOCUMENTS

a. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

2. SUMMARY

a. Section includes colored, stamped, stenciled] and stained concrete paving.

b. Related Requirements:

1) Section 033000 "Cast-in-Place Concrete for general building applications of concrete.
2) Section 321313 "Concrete Paving" for cast-in-place concrete paving with other finishes, curbs and gutters, and stamped detectable warnings.
3) Section 321373 "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within decorative concrete paving and in joints between decorative concrete paving and other paving or adjacent construction.

3. DEFINITIONS

a. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.

b. W/C Ratio: The ratio by weight of water to cementitious materials.

4. PREINSTALLATION MEETINGS

a. Preinstallation Conference: Conduct conference at Wilson Hall.

1) Review methods and procedures related to decorative concrete paving, including but not limited to, the following:

a) Concrete mixture design.
b) Quality control of concrete materials and decorative concrete paving construction practices.

2) Require representatives of each entity directly concerned with decorative concrete paving to attend, including the following:

a) Contractor's superintendent.
b) Independent testing agency responsible for concrete design mixtures.
c) Ready-mix concrete manufacturer.
d) Decorative concrete paving Installer.
e) Manufacturer's representative of decorative concrete paving system.

5. ACTION SUBMITTALS

a. Product Data: For each type of product.

b. Sustainable Design Submittals:

c. Samples for Initial Selection: For each type of product, ingredient, or admixture requiring color, pattern, or texture selection.

d. Samples for Verification: For each type of exposed color, pattern, or texture indicated.

e. Design Mixtures: For each decorative concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

6. INFORMATIONAL SUBMITTALS

a. Qualification Data: For qualified Installer , ready-mix concrete manufacturer and testing agency.

b. Material Certificates: For the following, from manufacturer:

1) Cementitious materials.
2) Steel reinforcement and reinforcement accessories.
3) Fiber reinforcement.
4) Admixtures.
5) Curing compounds.
6) Applied finish materials.
7) Bonding agent or epoxy adhesive.
8) Joint fillers.

c. Material Test Reports: For each of the following:

1) Aggregates.[**Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.**]

d. Field quality-control reports.

7. QUALITY ASSURANCE

a. Installer Qualifications: An employer of workers trained and approved by manufacturer of decorative concrete paving systems.

b. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1) Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

c. Testing Agency Qualifications: Qualified according to ASTM C1077 and ASTM E329 for testing indicated.

1) Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

d. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1) Build mockups of full-thickness sections of decorative concrete paving to demonstrate typical joints; surface color, pattern, and texture; curing; and standard of workmanship.
2) Build mockups of decorative concrete paving in the location and of the size indicated or, if not indicated, build mockups where directed by Architect and not less than 96 inches by 96 inches.
3) Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4) Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

8. PRECONSTRUCTION TESTING

a. Preconstruction Testing Service: Engage a qualified independent testing agency to perform preconstruction testing on decorative concrete paving mixtures.

9. FIELD CONDITIONS

a. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

b. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

1) When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
2) Do not use frozen materials or materials containing ice or snow.
3) Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

c. Hot-Weather Concrete Placement: Comply with ACI 301and as follows when hot-weather conditions exist:

1) Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2) Cover steel reinforcement with water-soaked burlap, so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3) Fog-spray forms[**, steel reinforcement,**] and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

PART 2 PRODUCTS

1. CONCRETE, GENERAL

a. ACI Publications: Comply with ACI 301 unless otherwise indicated.

2. FORMS

a. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.

1) Use flexible or uniformly curved forms for curves of a radius of 100 feet or less. Do not use notched and bent forms.

b. Forms for Textured Finish Concrete: Units of face design, size, arrangement, and configuration indicated. Provide solid backing and form supports to ensure stability of textured form liners.

c. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

3. STEEL REINFORCEMENT

a. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, fabricated from as-drawn steel wire into flat sheets.

b. Reinforcing Bars: ASTM A615/A615M, Grade 60; deformed.

c. Steel Bar Mats: ASTM A184/A184M; with ASTM A615/A615M, Grade 60 deformed bars; assembled with clips.

d. Plain-Steel Wire: ASTM A1064/A1064M, as drawn.

e. Joint Dowel Bars: ASTM A615/A615M, Grade 60 plain-steel bars. Cut bars true to length with ends square and free of burrs.

f. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded-wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:

1) Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

4. CONCRETE MATERIALS

a. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

b. Cementitious Materials:

1) Portland Cement: ASTM C150/C150M, **gray** or **white** portland cement [Type I] [Type II] [Type I/II] [Type III] [Type V].
2) Fly Ash: ASTM C618, Class C or F.
3) Slag Cement: ASTM C989/C989M, Grade 100 or 120.

4) Blended Hydraulic Cement: ASTM C595/C595M, [Type IS, portland blast-furnace slag] [Type IP, portland-pozzolan] [Type IL, Portland-limestone] [Type IT, ternary blended] cement.

c. Normal-Weight Aggregates: ASTM C33/C33M, Class 4S or Class 4M uniformly graded. Provide aggregates from a single source[with documented service-record data of at least 10 years' satisfactory service in similar paving applications and service conditions using similar aggregates and cementitious materials].

1) Maximum Coarse-Aggregate Size: 1 inch nominal.
2) Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

d. Air-Entraining Admixture: ASTM C260/C260M.

e. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

1) Water-Reducing Admixture: ASTM C494/C494M, Type A**,** colored.
2) Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D, colored.
3) Water-Reducing and Accelerating Admixture: ASTM C494/C494M, Type E.

f. Color Pigment: ASTM C979/C979M, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.

g. Water: Potable and complying with ASTM C94/C94M.

5. FIBER REINFORCEMENT

a. Synthetic Fiber: Monofilament polypropylene fibers engineered and designed for use in decorative concrete paving, complying with ASTM C1116/C1116M, Type III, 1/2 to 1-1/2 inches long.

b. Synthetic Fiber: Fibrillated polypropylene fibers engineered and designed for use in decorative concrete paving, complying with ASTM C1116/C1116M, Type III, 1/2 to 1-1/2 inches long.

6. SURFACE COLORING MATERIALS

a. Pigmented Mineral Dry-Shake Hardener: Factory-packaged, dry combination of portland cement, graded quartz aggregate, color pigments, and plasticizing admixture. Use color pigments that are finely ground, nonfading mineral oxides interground with cement.

b. Pigmented Powder Release Agent: Factory-packaged, dry combination of surface-conditioning and dispersing agents interground with color pigments that facilitates release of stamp mats. Use color pigments that are finely ground, nonfading mineral oxides interground with cement.≤

c. Liquid Release Agent: Manufacturer's standard, clear, evaporating formulation that facilitates release of stamp mats and texture rollers.

7. STAMPING DEVICES

a. Stamp Mats: Semirigid polyurethane mats with projecting textured and ridged underside capable of imprinting texture and joint patterns on plastic concrete.

b. Stamp Tools: Open-grid, aluminum or rigid-plastic stamp tool capable of imprinting joint patterns on plastic concrete.

c. Rollers: Manually controlled, water-filled aluminum rollers with projecting ridges on drum capable of imprinting texture and joint patterns on plastic concrete.

d. Texture Rollers: Manually controlled, abrasion-resistant polyurethane rollers capable of imprinting texture on plastic concrete.

8. STENCIL MATERIALS

a. Stencils: Manufacturer's standard, moisture-resistant paper or reusable plastic stencils, designed for use on plastic concrete.

9. STAIN MATERIALS

a. Reactive Stain: Acidic-based stain with wetting agents and high-grade, UV-stable metallic salts that react with calcium hydroxide in cured concrete to produce permanent, variegated, or translucent color effects.

b. Penetrating Stain: Water-based, acrylic latex, penetrating stain with colorfast pigments.

10. CURING AND SEALING MATERIALS

a. Curing Paper: Nonstaining, waterproof paper, consisting of two layers of kraft paper cemented together and reinforced with fiber, and complying with ASTM C171.

b. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.

c. Waterborne, Membrane-Forming, Curing Compound: ASTM C309, Type 1, Class B, nondissipating, non-yellowing, manufactured for use with colored concrete.

1) Curing compound shall be pigmented type matching color of integrally colored concrete and shall be approved by coloring admixture manufacturer.
2) For concrete indicated to be sealed, curing compound shall be compatible with sealer.

d. High-Solids, Waterborne, Membrane-Forming, Curing Compound: ASTM C309, Type 1, Class B, 18 to 25 percent solids, nondissipating, non-yellowing, manufactured for use with colored concrete..

1) Curing compound shall be pigmented type matching color of integrally colored concrete and shall be approved by coloring admixture manufacturer.
2) For concrete indicated to be sealed, curing compound shall be compatible with sealer.

e. Clear, Solvent-Borne, Membrane-Forming, Curing and Sealing Compound: ASTM C1315, Type 1, Class A, manufactured for use with colored concrete.

f. Clear, Waterborne, Membrane-Forming, Curing and Sealing Compound: ASTM C1315, Type 1, Class A, manufactured for use with colored concrete.

g. Clear Acrylic Sealer, Low-to-Medium Gloss: Manufacturer's standard, waterborne, non-yellowing and UV-resistant, membrane-forming, acrylic copolymer emulsion or epoxy-modified acrylic emulsion, manufactured for colored concrete, containing not less than 15 percent solids by volume.

h. Clear Acrylic Sealer, High Gloss: Manufacturer's standard, waterborne, non-yellowing and UV-resistant, membrane-forming, high-gloss, acrylic copolymer emulsion solution, manufactured for colored concrete, containing not less than 25 percent solids by volume.

i. Slip-Resistance-Enhancing Additive: Manufacturer's standard finely graded aggregate or polymer additive, designed to be added to clear acrylic sealer to enhance slip resistance of sealed paving surface.

11. RELATED MATERIALS

a. Joint Fillers: D1751, asphalt-saturated cellulosic fiber or ASTM D1752, cork or self-expanding cork in preformed strips.

b. Bonding Agent: ASTM C1059/C1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

c. Epoxy-Bonding Adhesive: ASTM C881/C881M, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:

1) Types I and II, nonload bearing] [Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

d. Polyethylene Film: ASTM D4397, 1 mil thick, clear.

12. CONCRETE MIXTURES

a. Obtain each color, size, type, and variety of concrete mixture from single manufacturer with resources to provide concrete of consistent quality in appearance and physical properties.

b. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.

1) Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.

c. Cementitious Materials:Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.][Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1) Fly Ash or Pozzolan: 25 percent.
2) Slag Cement: 50 percent.
3) Combined Fly Ash or Pozzolan, and Slag Cement: 50 percent, with fly ash or pozzolan not exceeding 25 percent.

d. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

1) Air Content: 4-1/2percent plus or minus 1.5 percent for 1-1/2-inch nominal maximum aggregate size.
2) Air Content: 4-1/2 percent plus or minus 1.5 percent for 1-inch nominal maximum aggregate size.
3) Air Content: 5 percent plus or minus 1.5 percent for 3/4-inch nominal maximum aggregate size.

e. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

f. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

1) Use water-reducing admixture or reducing and accelerating admixture in concrete as required for placement and workability.
2) Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

g. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd.

h. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

i. Concrete Mixtures: Normal-weight concrete.

1) Compressive Strength (28 Days): 3000 psi.
2) Maximum W/C Ratio at Point of Placement: 0.50.
3) Slump Limit: 4 inches plus or minus 1 inch.

13. CONCRETE MIXING

a. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M and ASTM C1116/C1116M. Furnish batch certificates for each batch discharged and used in the Work.

1) When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

b. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1) For concrete batches of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2) For concrete batches larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
3) Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

PART 3 EXECUTION

1. EXAMINATION

a. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

b. Proof-roll prepared subbase surface below decorative concrete paving to identify soft pockets and areas of excess yielding.

1) Completely proof-roll subbase in one direction[and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
2) Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3) Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Section 312000 "Earth Moving."

c. Proceed with installation only after unsatisfactory conditions have been corrected.

2. PREPARATION

a. Remove loose material from compacted subbase surface immediately before placing concrete.

b. Protect adjacent construction from discoloration and spillage during application of color hardeners, release agents, stains, curing compounds, and sealers.

3. EDGE FORMS AND SCREED CONSTRUCTION

a. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

b. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

4. STEEL REINFORCEMENT INSTALLATION

a. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

b. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

c. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

d. Install welded-wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

e. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap to adjacent mats.

5. JOINTS

a. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

1) When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

b. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.

1) Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
2) Butt Joints: Use bonding agent or epoxy-bonding adhesive at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
3) Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
4) Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

c. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.

1) Locate expansion joints at intervals of 50 feet unless otherwise indicated.
2) Extend joint fillers full width and depth of joint.
3) Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
4) Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
5) Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6) During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

d. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows to match jointing of existing adjacent decorative concrete paving:

1) Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.

a) Tolerance: Ensure that grooved joints are within 3 inches either way from centers of dowels.

2) Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

a) Tolerance: Ensure that sawed joints are within 3 inches in both directions from centers of dowels.

3) Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

e. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

6. CONCRETE PLACEMENT

a. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.

b. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.

c. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

d. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

e. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

f. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

g. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

1) Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only

square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement dowels and joint devices.

h. Screed paving surface with a straightedge and strike off.

i. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

7. FLOAT FINISHING

a. General: Do not add water to concrete surfaces during finishing operations.

b. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

8. INTEGRALLY COLORED CONCRETE FINISH

a. Integrally Colored Concrete Finish: After final floating, apply the following finish:

1) Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
2) Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.
3) Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

9. STENCILING

a. Cut stencils to slab width and lay on wet concrete. Overlap "mortar joint" on trailing edge of each section of stencil onto leading "mortar joint" of previous section.

b. Trim stencils to fit slab and adjacent patterns.

c. Slightly embed stencil into concrete by rolling with stencil roller.

d. Apply pigmented mineral dry-shake hardener materials to concrete surfaces according to manufacturer's written instructions.

e. Stencil Rolling:

1) Apply pigmented powder release agent and liquid release agent according to manufacturer's written instructions prior to applying texture roller to surface of concrete.
2) Perform rolling operation to produce required texture on concrete surface.

f. Remove stencils when concrete has sufficiently cured to bear weight. Do not leave stencils in concrete overnight.

g. Remove debris with mechanical blower prior to application of curing compound. If release agent is applied, delay removal of debris for 24 hours, then flood area with low-pressure water hose, wetting release agent, and follow by cleaning surface with pressure washer.

10. PIGMENTED MINERAL DRY-SHAKE HARDENER APPLICATION

a. Pigmented Mineral Dry-Shake Hardener Finish: After initial floating, apply dry-shake materials to paving surfaces according to manufacturer's written instructions and as follows:

1) Uniformly apply dry-shake hardener at a rate of 100 lb/100 sq. ft. unless greater amount is recommended by manufacturer to match paving color required.
2) Uniformly distribute approximately two-thirds of dry-shake hardener over the concrete surface with mechanical spreader; allow hardener to absorb moisture and embed it by power floating. Follow power floating with a second application of pigmented mineral dry-shake hardener, uniformly distributing remainder of material at right angles to first application to ensure uniform color, and embed hardener by final power floating.
3) After final power floating, apply the following finish:

a) Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
b) Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.
c) Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

b. Pigmented Powder Release Agent: Uniformly distribute onto dry-shake-hardened and still-plastic concrete at a rate of 3 to 4 lb/100 sq. ft.

c. Liquid Release Agent: Uniformly mist surface of dry-shake-hardened and still-plastic concrete at a rate of 5 gal/1000 sq. ft.

11. STAMPING

a. Mat Stamping: After floating and while concrete is plastic, apply mat-stamped finish.

1) Pigmented Powder Release Agent: Uniformly distribute onto concrete at a rate of 3 to 4 lb/100 sq. ft.
2) Liquid Release Agent: Apply liquid release agent to the concrete surface and the stamp mat. Uniformly mist surface of concrete at a rate of 5 gal/1000 sq. ft.
3) After application of release agent, accurately align and place stamp mats in sequence.
4) Uniformly load mats and press into concrete to produce required imprint pattern and depth of imprint on concrete surface. Gently remove stamp mats. Hand stamp edges and surfaces unable to be imprinted by stamp mats.
5) Remove residual release agent according to manufacturer's written instructions, but no fewer than three days after stamping concrete. High-pressure-wash surface and joint patterns, taking care not to damage stamped concrete. Control, collect, and legally dispose of runoff.

b. Tool Stamping: After floating and while concrete is plastic, apply tool-stamped finish.

1) Cover surface with polyethylene film, stretch taut to remove wrinkles, lap sides and ends 3 inches , and secure to edge forms. Lightly broom surface to remove air bubbles.
2) Accurately align and place stamp tools in sequence and tamp into concrete to produce required imprint pattern and depth of imprint on concrete surface. Gently remove stamp tools. Hand stamp edges and surfaces unable to be imprinted by stamp tools.
3) Carefully remove polyethylene film immediately after tool stamping.

c. Roller Stamping: After floating and while concrete is plastic, apply roller-stamped finish.

1) Cover surface with polyethylene film, stretch taut to remove wrinkles, lap sides and ends 3 inches, and secure to edge forms. Lightly broom surface to remove air bubbles.
2) Accurately align roller and perform rolling operation to produce required imprint pattern and depth of imprint on concrete surface. Hand stamp surfaces inaccessible to roller.
3) Carefully remove polyethylene film immediately after roller stamping.

12. CONCRETE PROTECTION AND CURING

a. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

b. Comply with ACI 306.1 for cold-weather protection.

c. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

d. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

e. Curing Compound: Apply immediately after final finishing. Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

1) Cure integrally colored concrete with a pigmented curing compound.
2) Cure concrete finished with pigmented mineral dry-shake hardener with a pigmented curing compound.

f. Curing and Sealing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

g. Curing Paper: Cure with unwrinkled curing paper in pieces large enough to cover the entire width and edges of slab. Do not lap sheets. Fold curing paper down over paving edges and secure with continuous banks of earth to prevent displacement or billowing due to wind. Immediately repair holes or tears in paper.

13. STAINING

a. Newly placed concrete paving shall be at least 14 days old before staining.

b. Prepare surfaces according to manufacturer's written instructions and as follows:

1) Clean concrete thoroughly by scraping, applying solvents or stripping agents, sweeping and pressure washing, or scrubbing with a rotary floor machine and detergents recommended by stain manufacturer. Rinse until water is clear and allow surface to dry.

a) Do not use acidic solutions to clean surfaces.

2) Test surfaces with droplets of water. If water beads and does not penetrate surface, or penetrates only in some areas, profile surfaces by acid etching, grinding, sanding, or abrasive blasting. Retest and continue profiling surface until water droplets immediately darken and uniformly penetrate concrete surfaces.
3) Apply acidic solution to dampened concrete surfaces, scrubbing with uncolored, acid-resistant nylon-bristle brushes until bubbling stops and concrete surface has texture of 120-grit sandpaper. Do not allow solution to dry on concrete surfaces. Rinse until water is clear. Control, collect, and legally dispose of runoff.
4) Neutralize concrete surfaces and rinse until water is clear. Test surface for residue with clean white cloth. Test surface according to ASTM F710 to ensure pH is between 7 and 8.

c. Scoring: Score decorative jointing in paving surfaces 1/16 inch deep with diamond blades to match pattern indicated. Rinse until water is clear. Score after staining.

1) Joint Width: 3/8 inch.

d. Allow paving surface to dry before applying stain. Verify readiness of paving to receive stain according to ASTM D4263 by tightly taping 18-by-18-inch, 4-mil-thick polyethylene sheet to a representative area of paving surface. Apply stain only if no evidence of moisture has accumulated under sheet after 16 hours.

e. Reactive Stain: Apply reactive stain to paving surfaces according to manufacturer's written instructions and as follows:

1) Apply stain by uncolored bristle brush, roller, or high-volume, low-pressure sprayer and immediately scrub into concrete surface with uncolored, acid-resistant nylon-bristle brushes in continuous, circular motion. Do not spread stain after fizzing stops. Allow to dry four hours and repeat application of stain in sufficient quantity to obtain color consistent with approved mockup.
2) Remove stain residue after four hours by wet scrubbing with commercial-grade detergent recommended by stain manufacturer. Rinse until water is clear. Control, collect, and legally dispose of runoff.

f. Penetrating Stain: Apply to paving surfaces according to manufacturer's written instructions and as follows:

1) Apply first coat of stain to dry, clean surfaces by airless sprayer or by high-volume, low-pressure sprayer.
2) Allow to dry four hours and repeat application of stain in sufficient quantity to obtain color consistent with approved mockup.
3) Rinse until water is clear. Control, collect, and legally dispose of runoff.

14. SEALER APPLICATION

a. Clear Acrylic Sealer: Apply uniformly in two coats in continuous operations according to manufacturer's written instructions. Allow first coat to dry before applying second coat, at 90 degrees to the direction of the first coat, using same application methods and rates.

1) Begin sealing dry surface no sooner than 14 days after concrete placement.
2) Allow stained concrete surfaces to dry before applying sealer.
3) Thoroughly mix slip-resistance-enhancing additive into sealer before applying sealer according to manufacturer's written instructions. Stir sealer occasionally during application to maintain even distribution of additive.

15. PAVING TOLERANCES

a. Comply with tolerances in ACI 117 and as follows:

1) Elevation: 3/4 inch.
2) Thickness: Plus 3/8 inch, minus 1/4 inch.
3) Surface: Gap below 10-foot-long, unleveled straightedge not to exceed 1/2 inch.
4) Lateral Alignment and Spacing of Dowels: 1 inch.
5) Vertical Alignment of Dowels: 1/4 inch.
6) Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
7) Joint Spacing: 3 inches.
8) Contraction Joint Depth: Plus 1/4 inch, no minus.
9) Joint Width: Plus 1/8 inch, no minus.

16. FIELD QUALITY CONTROL

a. Testing Agency: **Owner will engage**a qualified testing agency to perform tests and inspections.

b. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C172/C172M shall be performed according to the following requirements:

1) Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or 5000 sq. ft. or fraction thereof of each concrete mixture placed each day.

a) When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2) Slump: ASTM C143/C143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3) Air Content: ASTM C231/C231M, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4) Concrete Temperature: ASTM C1064/C1064M; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
5) Compression Test Specimens: ASTM C31/C31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6) Compressive-Strength Tests: ASTM C39/C39M; test one specimen at seven days and two specimens at 28 days.

a) A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

c. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

d. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

e. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

f. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

g. Decorative concrete paving will be considered defective if it does not pass tests and inspections.

h. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

i. Prepare test and inspection reports.

17. REPAIR AND PROTECTION

a. Remove and replace decorative concrete paving that is broken or damaged or does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

b. Detailing: Grind concrete "squeeze" left from tool placement. Color ground areas with slurry of color hardener mixed with water and bonding agent. Remove excess release agent with high-velocity blower.

c. Protect decorative concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

d. Maintain decorative concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

18. DECORATIVE CONCRETE PAVING SCHEDULE **N/A**

a. Patterned Decorative Concrete Paving:

1) Locations: Install at walks
2) Coloring Method: Integrally colored or Pigmented mineral dry-shake hardener].

a) Color: Match Architect's sample

3) Field Patterning Method: [**Stamped**] [**Stenciled**].???

a) Texture and Pattern: [**Keystone installed at 45-degrees diagonal to main lines of building**].???
b) Pigmented Mineral Dry-Shake Hardener:
c) Release Agent: Match pigmented mineral dry-shake hardener.

4) Border and Accent Strip Patterning Method: [**Stamped**] [**Stenciled**].???

a) Texture and Pattern: .
b) Pigmented Mineral Dry-Shake Hardener: .
c) Release Agent: Match pigmented mineral dry-shake hardener .

b. Stained Decorative Concrete Paving:

1) Locations: Install at walks and patios.
2) Staining Method: [**Reactive**] [**Penetrating**] stain.
3) Color: As selected by Architect from manufacturer's full range

END OF SECTION 321316

SECTION 321373 - CONCRETE PAVING JOINT SEALANTS

PART 1 GENERAL

1. RELATED DOCUMENTS

a. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

2. SUMMARY

a. Section Includes:

1) Cold-applied joint sealants.
2) Hot-applied joint sealants.
3) Cold-applied, fuel-resistant joint sealants.
4) Hot-applied, fuel-resistant joint sealants.
5) Joint-sealant backer materials.
6) Primers.

b. Related Requirements:

1) Section 079200 "Joint Sealants" for sealing nontraffic and traffic joints in locations not specified in this Section.

3. PREINSTALLATION MEETINGS

a. Preinstallation Conference: Conduct conference at Wilson Hall.

4. ACTION SUBMITTALS

a. Product Data: For each type of product.

b. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

c. Paving-Joint-Sealant Schedule: Include the following information:

1) Joint-sealant application, joint location, and designation.
2) Joint-sealant manufacturer and product name.
3) Joint-sealant formulation.
4) Joint-sealant color.

5. INFORMATIONAL SUBMITTALS

a. Qualification Data: For Installer and testing agency.

b. Product Certificates: For each type of joint sealant and accessory.

6. QUALITY ASSURANCE

a. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

b. Product Testing: Test joint sealants using a qualified testing agency.

7. FIELD CONDITIONS

a. Do not proceed with installation of joint sealants under the following conditions:

1) When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer[or are below 40 deg F.
2) When joint substrates are wet.
3) Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4) Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 PRODUCTS

1. MATERIALS, GENERAL

a. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

2. COLD-APPLIED JOINT SEALANTS

   a. Single-Component, Nonsag, Silicone Joint Sealant: ASTM D5893/D5893M, Type NS.

   b. Single-Component, Self-Leveling, Silicone Joint Sealant: ASTM D5893/D5893M, Type SL.

   c. Multicomponent, Nonsag, Urethane, Elastomeric Joint Sealant: ASTM C920, Type M, Grade NS, Class 25, for Use T.

   d. Single Component, Pourable, Urethane, Elastomeric Joint Sealant: ASTM C920, Type S, Grade P, Class 25, for Use T.

   e. Multicomponent, Pourable, Urethane, Elastomeric Joint Sealant: ASTM C920, Type M, Grade P, Class 25, for Use T.

3. HOT-APPLIED JOINT SEALANTS

   a. Hot-Applied, Single-Component Joint Sealant: ASTM D6690, Type I.

   b. Hot-Applied, Single-Component Joint Sealant: ASTM D6690, Type I or Type II.

   c. Hot-Applied, Single-Component Joint Sealant: ASTM D6690, Type I, II, or III.

   d. Hot-Applied, Single-Component Joint Sealant: ASTM D6690, Type IV.

4. COLD-APPLIED, FUEL-RESISTANT JOINT SEALANTS

   a. Fuel-Resistant, Single-Component, Pourable, Modified-Urethane, Elastomeric Joint Sealant: ASTM C920, Type S, Grade P, Class 25, for Use T.

   b. Fuel-Resistant, Multicomponent, Pourable, Modified-Urethane, Elastomeric Joint Sealant: ASTM C920, Type M, Grade P, Class 12-1/2 or 25, for Use T.

5. HOT-APPLIED, FUEL-RESISTANT JOINT SEALANTS

   a. Hot-Applied, Fuel-Resistant, Single-Component Joint Sealants: ASTM D7116, Type I or Type II.

   b. Hot-Applied, Fuel-Resistant, Single-Component Joint Sealants: ASTM D7116, Type III.

6. JOINT-SEALANT BACKER MATERIALS

a. Joint-Sealant Backer Materials: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by joint-sealant manufacturer, based on field experience and laboratory testing.

b. Round Backer Rods for Cold- and Hot-Applied Joint Sealants: ASTM D5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

c. Round Backer Rods for Cold-Applied Joint Sealants: ASTM D5249, Type 3, of diameter and density required to control joint-sealant depth and prevent bottom-side adhesion of sealant.

d. Backer Strips for Cold- and Hot-Applied Joint Sealants: ASTM D5249; Type 2; of thickness and width required to control joint-sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

7. PRIMERS

a. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated.

PART 3 EXECUTION

1. EXAMINATION

a. Examine joints to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

b. Proceed with installation only after unsatisfactory conditions have been corrected.

2. PREPARATION

a. Surface Cleaning of Joints: Before installing joint sealants, clean out joints immediately to comply with joint-sealant manufacturer's written instructions.

1) Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

b. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3. INSTALLATION OF JOINT SEALANTS

a. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.

b. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions.

c. Install joint-sealant backings to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1) Do not leave gaps between ends of joint-sealant backings.
2) Do not stretch, twist, puncture, or tear joint-sealant backings.
3) Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.

d. Install joint sealants immediately following backing installation, using proven techniques that comply with the following:

1) Place joint sealants so they fully contact joint substrates.
2) Completely fill recesses in each joint configuration.
3) Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

e. Tooling of Nonsag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint:

1) Remove excess joint sealant from surfaces adjacent to joints.
2) Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

f. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.

4. CLEANING AND PROTECTION

a. Clean off excess joint sealant as the Work progresses, by methods and with cleaning materials approved in writing by joint-sealant manufacturers.

b. Protect joint sealants, during and after curing period, from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.

5. PAVING-JOINT-SEALANT SCHEDULE

a. Joint-Sealant Application: Joints within concrete paving[<**PJS-#**>].

1) Joint Location:

a) Expansion and isolation joints in concrete paving.
b) Contraction joints in concrete paving.
c) Other joints as indicated.

2) Joint Sealant: [Single-component, nonsag, silicone joint sealant] [Single-component, self-leveling, silicone joint sealant] [Multicomponent, nonsag, urethane, elastomeric joint sealant] [Single component, pourable, urethane, elastomeric joint sealant] [Multicomponent, pourable, urethane, elastomeric joint sealant] [Hot-applied, single-component joint sealant].
3) Joint-Sealant Color: Manufacturer's standard.

b. Joint-Sealant Application: Joints within concrete paving and between concrete and asphalt paving.

1) Joint Location:

a) Joints between concrete and asphalt paving.
b) Joints between concrete curbs and asphalt paving.
c) Other joints as indicated.

2) Joint Sealant: Hot-applied, single-component joint sealant.
3) Joint-Sealant Color: Manufacturer's standard.

c. Joint-Sealant Application: Fuel-resistant joints within concrete paving.

1) Joint Location:

a) Expansion and isolation joints in concrete paving.
b) Contraction joints in concrete paving.
c) Other joints as indicated.

2) Joint Sealant: Fuel-resistant, single-component, pourable, modified-urethane, elastomeric joint sealant or Fuel-resistant, multicomponent, pourable, modified-urethane, elastomeric joint sealant or Hot-applied, fuel-resistant, single-component joint sealant].

3) Joint-Sealant Color: Manufacturer's standard.

END OF SECTION 321373

SECTION 329113 - SOIL PREPARATION

PART 1 GENERAL

1. RELATED DOCUMENTS

a. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

2. SUMMARY

a. Section includes soil media for the bioretention systems and rain gardens specified according to performance requirements of the mixes. In general, the media is suitable for a variety of plant species however, careful consideration of system hydrology and solar radiation should be included in plant selection. Section includes planting soils and layered soil assemblies specified by composition of the mixes.

b. Related Requirements:

1) Section 323300 "Site Furnishings" for placing planting soil in exterior unit planters.
2) Section 311000 "Site Clearing" for topsoil stripping and stockpiling.
3) Section 321443 "Porous Unit Paving" for placing planting-soil fill in porous paving
4) Section 329300 "Plants" for placing planting soil for plantings.
5) Section 329600 "Transplanting" for placing planting soil in tree planting pits.

3. ALLOWANCES

a. Preconstruction and field quality-control testing are part of testing and inspecting allowance.

4. UNIT PRICES

a. Work of this Section is affected by unit prices specified in “Section 012200 "Unit Prices."

5. DEFINITIONS

a. AAPFCO: Association of American Plant Food Control Officials.

b. Backfill: The earth used to replace or the act of replacing earth in an excavation. This can be amended or unamended soil as indicated.

c. CEC: Cation exchange capacity.

d. Compost: The product resulting from the controlled biological decomposition of organic material that has been sanitized through the generation of heat and stabilized to the point that it is beneficial to plant growth.

e. Duff Layer: A surface layer of soil, typical of forested areas, that is composed of mostly decayed leaves, twigs, and detritus.

f. Imported Soil: Soil that is transported to Project site for use.

g. Layered Soil Assembly: A designed series of planting soils, layered on each other, that together produce an environment for plant growth.

h. Manufactured Soil: Soil produced by blending soils, sand, stabilized organic soil amendments, and other materials to produce planting soil.

i. NAPT: North American Proficiency Testing Program. An SSSA program to assist soil-, plant-, and water-testing laboratories through interlaboratory sample exchanges and statistical evaluation of analytical data.

j. Organic Matter: The total of organic materials in soil exclusive of undecayed plant and animal tissues, their partial decomposition products, and the soil biomass; also called "humus" or "soil organic matter."

k. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified as specified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

l. RCRA Metals: Hazardous metals identified by the EPA under the Resource Conservation and Recovery Act.

m. SSSA: Soil Science Society of America.

n. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

o. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

p. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil"; but in disturbed areas such as urban environments, the surface soil can be subsoil.

q. USCC: U.S. Composting Council.

r.. Bioretention Soil Mix (BSM): Existing, on-site soil; imported soil; or manufactured soil that has been modified as specified with soil amendments. A soil mixture best for media filtration

s. Cation exchange capacity (CEC): a measure of the soil's ability to hold positively charged ions.

t. Organic Matter: The total organic materials in soil and the soil biomass; also called "humus" or "soil organic matter."

u. Subgrade: Surface and/or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill above which a bioretention system is constructed.

6. PREINSTALLATION MEETINGS

a. Preinstallation Conference: Conduct conference at Wilson Hall.

7. ACTION SUBMITTALS

a. Product Data: For each type of product.

1) Include recommendations for application and use.
2) Include test data substantiating that products comply with requirements.
3) Include sieve analyses for aggregate materials.
4) Material Certificates: For each type of imported soil and soil amendment and fertilizer delivery to the site, according to the following:

a) Manufacturer's qualified testing agency's certified analysis of standard products.
b) Analysis of fertilizers, by a qualified testing agency, made according to AAPFCO methods for testing and labeling and according to AAPFCO's SUIP #25.
c) Analysis of nonstandard materials, by a qualified testing agency, made according to SSSA methods, where applicable.

b. Sustainable Design Submittals:

1)

c. Samples: For each bulk-supplied material, 1-quart volume of each in sealed containers labeled with content, source, and date obtained. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of composition, color, and texture.

8. INFORMATIONAL SUBMITTALS

a. Qualification Data: For each testing agency.

b. Preconstruction Test Reports: For preconstruction soil analyses specified in "Preconstruction Testing" Article.

c. Field quality-control reports.

9. QUALITY ASSURANCE

a. Testing Agency Qualifications: An independent, state-operated, or university-operated laboratory; experienced in soil science, soil testing, and plant nutrition; with the experience and capability to conduct the testing indicated; and that specializes in types of tests to be performed.

1) Laboratories: Subject to compliance with requirements, as designated by the owner's representative

2) Multiple Laboratories: At Contractor's option, work may be divided among qualified testing laboratories specializing in physical testing, chemical testing, and fertility testing.

10. PRECONSTRUCTION TESTING

a. Preconstruction Testing Service: Owner will engage a qualified testing agency to perform preconstruction soil analyses on existing, on-site soil and imported soil.

1) Notify Architect five busines days in advance of the dates and times when laboratory samples will be taken.

b. Preconstruction Soil Analyses: For each unamended soil type, perform testing on soil samples and furnish soil analysis and a written report containing soil-amendment and fertilizer recommendations by a qualified testing agency performing the testing according to "Soil-Sampling Requirements" and "Testing Requirements" articles.

1) Have testing agency identify and label samples and test reports according to sample collection and labeling requirements.

11. SOIL-SAMPLING REQUIREMENTS

a. General: Extract soil samples according to requirements in this article.

b. Sample Collection and Labeling: Have samples taken and labeled by Contractor in presence of Architect or Owner's representative under the direction of the testing agency.

1) Number and Location of Samples: Minimum of three representative soil samples [from varied locations or as where indicated on Drawings f or each soil to be used or amended for landscaping purposes.
2) Procedures and Depth of Samples: According to USDA-NRCS's "Field Book for Describing and Sampling Soils."
3) Division of Samples: Split each sample into two, equal parts. Send half to the testing agency and half to Owner for its records.
4) Labeling: Label each sample with the date, location keyed to a site plan or other location system, visible soil condition, and sampling depth.

12. TESTING REQUIREMENTS

a. General: Perform tests on soil samples according to requirements in this article.

b. Physical Testing:

1) Soil Texture: Soil-particle, size-distribution analysis by one of the following methods according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods":

a) Sieving Method: Report sand-gradation percentages for very coarse, coarse, medium, fine, and very fine sand; and fragment-gradation (gravel) percentages for fine, medium, and coarse fragments; according to USDA sand and fragment sizes.
b) Hydrometer Method: Report percentages of sand, silt, and clay.

2) Total Porosity: Calculate using particle density and bulk density according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
3) Water Retention: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
4) Saturated Hydraulic Conductivity: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods"; at 85% compaction according to ASTM D698 (Standard Proctor).

c. Chemical Testing:

1) CEC: Analysis by sodium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."

2) Clay Mineralogy: Analysis and estimated percentage of expandable clay minerals using CEC by ammonium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 1- Physical and Mineralogical Methods."
3) Metals Hazardous to Human Health: Test for presence and quantities of RCRA metals including aluminum, arsenic, barium, copper, cadmium, chromium, cobalt, lead, lithium, and vanadium. If RCRA metals are present, include recommendations for corrective action.
4) Phytotoxicity: Test for plant-available concentrations of phytotoxic minerals including aluminum, arsenic, barium, cadmium, chlorides, chromium, cobalt, copper, lead, lithium, mercury, nickel, selenium, silver, sodium, strontium, tin, titanium, vanadium, and zinc.

d. Fertility Testing: Soil-fertility analysis according to standard laboratory protocol of [SSSA NAPT NCR-13] [SSSA NAPT NEC-67] [SSSA NAPT SERA-6] [SSSA NAPT WERA-103], including the following:

1) Percentage of organic matter.
2) CEC, calcium percent of CEC, and magnesium percent of CEC.
3) Soil reaction (acidity/alkalinity pH value).
4) Buffered acidity or alkalinity.
5) Nitrogen ppm.
6) Phosphorous ppm.
7) Potassium ppm.
8) Manganese ppm.
9) Manganese-availability ppm.
10) Zinc ppm.
11) Zinc availability ppm.
12) Copper ppm.
13) Sodium ppm and sodium absorption ratio.
14) Soluble-salts ppm.
15) Presence and quantities of problem materials including salts and metals cited in the Standard protocol. If such problem materials are present, provide additional recommendations for corrective action.
16) Other deleterious materials, including their characteristics and content of each.

e. Organic-Matter Content: Analysis using loss-by-ignition method according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."

f. Recommendations: Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated to produce satisfactory planting soil suitable for healthy, viable plants indicated. Include, at a minimum, recommendations for nitrogen, phosphorous, and potassium fertilization, and for micronutrients.

1) Fertilizers and Soil Amendment Rates: State recommendations in weight [per 1000 sq. ft. for 6-inch depth of soil

2) Soil Reaction: State the recommended liming rates for raising pH or sulfur for lowering pH according to the buffered acidity or buffered alkalinity in weight [per 1000 sq. ft. for 6-inch depth of soil.

13. DELIVERY, STORAGE, AND HANDLING

a. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and compliance with state and Federal laws if applicable.

b. Bulk Materials:

1) Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2) Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3) Do not move or handle materials when they are wet or frozen.
4) Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

PART 2 PRODUCTS

1. SOIL MEDIA SPECIFIED ACCORDING TO PERFORMANCE REQUIREMENTS Particle Size Distribution according to ASTM D422 (Standard Test Method for Particle-Size Analysis of Soils).

1. Particle Size Distribution by Separates:

a. Exclude any material > 4.76 mm - 0%

b. Very Coarse Sand/Gravel: Gravel (2.0 to 4.76 mm) 5% maximum (percent by dry weight).

c. Sand (0.42 to 2.0 mm) 60 - 85% (percent by dry weight).

d. Silt (0.075 to 0.42 mm) 20% maximum (percent by dry weight).

e. Clay (less than 0.075mm) 5% maximum (percent by dry weight).

Table 1: Acceptable particle size distribution of final bioretention soil mix

Sieve #	Sieve Size in (mm)	% Passing
4	0.187 (4.76)	100
10	0..079 (2)	95
40	0.017 (0.42)	40-15
200	0.003 (0.075)	10-20
<200	Pan	0-5

2. Fragment Size Distribution:

a. Sticks and Roots: should be minimized and preferably limited to nothing larger than 4.76 mm
b. Debris and Other Foreign Materials: should be minimized

3. Percentage of Organic Matter: Minimum 3 percent by volume and maximum 8 percent by volume. 4. Soil Reaction: pH of 6 to 7. 5. CEC of Total Soil: Minimum 10 meq/100 mL at pH of 7.0. 6. Basis-of-Design Product: Subject to compliance with requirements indicated on Drawings 7. Basic Properties: Manufactured soil SHALL NOT contain the following:

a.Unacceptable Materials: Concrete slurry, concrete layers or chunks, cement, plaster, building debris, asphalt, bricks, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, solid waste, and other extraneous materials that are harmful to plant growth. b. Unsuitable Materials: Stones, roots, plants, sod, clay lumps, and pockets of coarse sand that exceed a combined maximum of 5 percent by dry weight of the manufactured soil. c. Large Materials: Stones, clods, roots, clay lumps, and pockets of coarse sand exceeding 0.187 inches (4.76 mm) in any dimension.

.2 ACCEPTABLE ORGANIC SOIL AMENDMENTS

A. No compost should be used in the planting mix unless specified by the engineer.

B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or of granular texture with 100 percent passing through a 1/2-inch (13-mm) sieve, a pH of 3.4 to 4.8.

C. Wood Derivatives: Shredded wood, wood chips, ground bark, or wood waste; of uniform texture and free of stones, sticks, soil, or toxic materials.

D. Media amendments such as zero-valent iron and/or drinking water treatment residuals (alum) to enhance phosphorus sorption as specified by the engineer.

PART 3 - EXECUTION

3.1 GENERAL

A. Place soil media according to requirements in other Specification Sections.

B. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, asphalt/concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, solid waste, or acid has been deposited in planting soil.

C. Proceed with placement only after unsatisfactory conditions have been corrected.

D. Compaction: Compact each blended lift of soil media to 75 percent of maximum Standard Proctor density according to ASTM D 698

E. Finish Grading: Grade soil media to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.2 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform the following tests and inspections: 1. Compaction: Test planting-soil compaction after placing each lift and at completion using a densitometer or soil-compaction meter calibrated to a reference test value based on laboratory testing according to ASTM D 698. 2. Retain "Performance Testing" Subparagraph below if required; revise to suit Project. 3. Performance Testing: For each amended soil media type, demonstrating compliance with specified performance requirements. Perform testing according to "Soil-Sampling Requirements" and "Testing Requirements" articles. C. Soil media will be considered defective if it does not pass tests and inspections. D. Prepare test and inspection reports. E. Label each sample and test report with the date, location keyed to a site plan or other location system, visible conditions when and where sample was taken, and sampling depth.

1) anting-soil type - see project drawings

2) Compaction: Test planting-soil compaction after placing each lift and at completion using a densitometer or soil-compaction meter calibrated to a reference test value based on laboratory testing according to ASTM D698. Space tests at no less than one for each 1000 sq. ft. of in-place soil or part thereof.

b. Soil will be considered defective if it does not pass tests and inspections.

c. Prepare test and inspection reports.

d. Label each sample and test report with the date, location keyed to a site plan or other location system, visible conditions when and where sample was taken, and sampling depth.

2. PROTECTION

a. Protection Zone: Identify protection zones according to Section 015639 "Temporary Tree and Plant Protection."

b. Protect areas of in-place soil from additional compaction, disturbance, and contamination. Prohibit the following practices within these areas except as required to perform planting operations:

1) Storage of construction materials, debris, or excavated material.
2) Parking vehicles or equipment.
3) Vehicle traffic.
4) Foot traffic.
5) Erection of sheds or structures.
6) Impoundment of water.
7) Excavation or other digging unless otherwise indicated.

c. If planting soil or subgrade is overcompacted, disturbed, or contaminated by foreign or deleterious materials or liquids, remove the planting soil and contamination; restore the subgrade as directed by Architect and replace contaminated planting soil with new planting soil.

3. CLEANING

a. Protect areas adjacent to planting-soil preparation and placement areas from contamination. Keep adjacent paving and construction clean and work area in an orderly condition.

b. Remove surplus soil and waste material including excess subsoil, unsuitable materials, trash, and debris and legally dispose of them off Owner's property unless otherwise indicated.

1) Dispose of excess subsoil and unsuitable materials on-site where directed by Owner.

END OF SECTION 329113

SECTION 330500 - COMMON WORK RESULTS FOR UTILITIES

PART 1 GENERAL

1. RELATED DOCUMENTS

a. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

2. SUMMARY

a. This Section includes the following:

1) Piping joining materials.
2) Transition fittings.
3) Dielectric fittings.
4) Sleeves.
5) Identification devices.
6) Grout.
7) Flowable fill.
8) Piped utility demolition.
9) Piping system common requirements.
10) Equipment installation common requirements.
11) Painting.
12) Concrete bases.
13) Metal supports and anchorages.

3. DEFINITIONS

a. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.

b. Concealed Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

c. ABS: Acrylonitrile-butadiene-styrene plastic.

d. CPVC: Chlorinated polyvinyl chloride plastic.

e. PE: Polyethylene plastic.

f. PVC: Polyvinyl chloride plastic.

4. ACTION SUBMITTALS

a. Product Data: For the following:

1) Dielectric fittings.
2) Identification devices.

5. INFORMATIONAL SUBMITTALS

a. Welding certificates.

6. QUALITY ASSURANCE

a. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

b. Steel Piping Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1) Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2) Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

c. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

7. DELIVERY, STORAGE, AND HANDLING

a. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

b. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

8. COORDINATION

a. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

b. Coordinate installation of identifying devices after completing covering and painting if devices are applied to surfaces.

c. Coordinate size and location of concrete bases. Formwork, reinforcement, and concrete requirements are specified in Section 033000 "Cast-in-Place Concrete."

PART 2 PRODUCTS

1. PIPING JOINING MATERIALS

a. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1) ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness, unless otherwise indicated.

a) Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b) Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2) AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

b. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

c. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

d. Solder Filler Metals: ASTM B32, lead-free alloys. Include water-flushable flux according to ASTM B813.

e. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

f. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

g. Solvent Cements for Joining Plastic Piping:

1) ABS Piping: ASTM D2235.
2) CPVC Piping: ASTM F493.
3) PVC Piping: ASTM D2564. Include primer according to ASTM F656.
4) PVC to ABS Piping Transition: ASTM D3138.

h. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2. TRANSITION FITTINGS

a. Transition Fittings, General: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

b. Transition Couplings NPS 1-1/2 and Smaller:

1) Underground Piping: Manufactured piping coupling or specified piping system fitting.
2) Aboveground Piping: Specified piping system fitting.

c. AWWA Transition Couplings NPS 2 and Larger:
1) Description: AWWA C219, metal sleeve-type coupling for underground pressure piping.

d. Plastic-to-Metal Transition Fittings:
1) Description: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint threaded end.

e. Plastic-to-Metal Transition Unions:
1) Description: MSS SP-107, CPVC and PVC -part union. Include brass or stainless-steel threaded end, solvent-cement-joint or threaded plastic end, rubber O-ring, and union nut.

f. Flexible Transition Couplings for Underground Nonpressure Drainage Piping:
1) Description: ASTM C1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

3. DIELECTRIC FITTINGS

a. Dielectric Fittings, General: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

b. Dielectric Unions:
1) Description: Factory fabricated, union, NPS 2 and smaller.

a) Pressure Rating:[150 psig 180 deg F
b) End Connections: Solder-joint copper alloy and threaded ferrous; threaded ferrous.

c. Dielectric Flanges:
   1) Description: Factory-fabricated, bolted, companion-flange assembly, NPS 2-1/2 to NPS 4 and larger.

      a) Pressure Rating: 150 psig
      b) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

d. Dielectric-Flange Kits:
   1) Description: Nonconducting materials for field assembly of companion flanges, NPS 2-1/2 and larger.

      a) Pressure Rating: 150 psig
      b) Gasket: Neoprene or phenolic.
      c) Bolt Sleeves: Phenolic or polyethylene.
      d) Washers: Phenolic with steel backing washers.

e. Dielectric Couplings:
   1) Description: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining, NPS 3 and smaller.

      a) Pressure Rating: 300 psig at 225 deg F
      b) End Connections: Threaded.

f. Dielectric Nipples:
   1) Description: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining.

      a) Pressure Rating: 300 psig at 225 deg F
      b) or grooved.

4. SLEEVES

a. Mechanical sleeve seals for pipe penetrations are specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

b. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

c. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, galvanized, plain ends.

d. Cast-Iron Sleeves: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

e. Molded PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.

f. PVC Pipe Sleeves: ASTM D1785, Schedule 40.

g. Molded PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

5. IDENTIFICATION DEVICES

a. General: Products specified are for applications referenced in other utilities Sections. If more than single type is specified for listed applications, selection is Installer's option.

b. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.

1) Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.
2) Location: Accessible and visible.

c. Stencils: Standard stencils prepared with letter sizes complying with recommendations in ASME A13.1. Minimum letter height is 1-1/4 inches for ducts, and 3/4 for access door signs and similar operational instructions.

1) Material: Fiberboard
2) Stencil Paint: Exterior, oil-based, alkyd-gloss black enamel, unless otherwise indicated. Paint may be in pressurized spray-can form.
3) Identification Paint: Exterior, oil-based, alkyd enamel in colors according to ASME A13.1, unless otherwise indicated.

d. Snap-on Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap-on type. Include color-coding according to ASME A13.1, unless otherwise indicated.

e. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, color-coded, pressure-sensitive-vinyl type with permanent adhesive.

f. Pipes with OD, Including Insulation, Less Than 6 Inches Full-band pipe markers, extending 360 degrees around pipe at each location.

g. Pipes with OD, Including Insulation, 6 Inches (150 mm) and Larger: Either full-band or strip-type pipe markers, at least three times letter height and of length required for label.

h. Lettering: Manufacturer's standard preprinted captions as selected by Architect.

i. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.

1) Arrows: Either integrally with piping system service lettering to accommodate both directions of flow, or as separate unit on each pipe marker to indicate direction of flow.

j. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive vinyl tape, at least 3 mils thick.

1) Width: 1-1/2 inches on pipes with OD, including insulation, less than 6 inches ; 2-1/2 inches (65 mm) for larger pipes.
2) Color: Comply with ASME A13.1, unless otherwise indicated.

k. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch sequenced numbers. Include 5/32-inch hole for fastener.

1) Material: 0.032-inch- (0.8-mm-) thick, polished brass or aluminum.
2) Material: 0.0375-inch- thick stainless steel.
3) Material: 3/32-inch- thick plastic laminate with 2 black surfaces and a white inner layer.
4) Material: Valve manufacturer's standard solid plastic.
5) Size: 1-1/2 inches in diameter, unless otherwise indicated.
6) Shape: As indicated for each piping system.

l. Valve Tag Fasteners: Brass, wire-link or beaded chain; or brass S-hooks.

m. Engraved Plastic-Laminate Signs: ASTM D709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.

1) Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.

2) Thickness: 1/16 inch for units up to 20 sq. in. or 8 inches in length, and 1/8 inch for larger units.
3) Fasteners: Self-tapping, stainless-steel screws or contact-type permanent adhesive.

n. Plastic Equipment Markers: Manufacturer's standard laminated plastic, in the following color codes:

1) Green: Cooling equipment and components.
2) Yellow: Heating equipment and components.
3) Brown: Energy reclamation equipment and components.
4) Blue: Equipment and components that do not meet criteria above.
5) Hazardous Equipment: Use colors and designs recommended by ASME A13.1.
6) Terminology: Match schedules as closely as possible. Include the following:

a) Name and plan number.
b) Equipment service.

c) Design capacity.
d) Other design parameters such as pressure drop, entering and leaving conditions, and speed.

7) Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches

o. : Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with mat finish suitable for writing.

1) Size: 3-1/4 by 5-5/8 inches.
2) Fasteners: Brass grommets and wire.
3) Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.

p. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in piped utility identification with corresponding designations indicated. Use numbers, letters, and terms indicated for proper identification, operation, and maintenance of piped utility systems and equipment.

1) Multiple Systems: Identify individual system number and service if multiple systems of same name are indicated.

6. GROUT

a. Description: ASTM C1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1) Characteristics: Post hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2) Design Mix: 5000-psi , 28-day compressive strength.
3) Packaging: Premixed and factory packaged.

7. FLOWABLE FILL

a. Description: Low-strength-concrete, flowable-slurry mix.

1) Cement: ASTM C150, Type I, portland.
2) Density: [115- to 145-lb/cu. ft.
3) Aggregates: ASTM C33, natural sand, fine and crushed gravel or stone, coarse.
4) Aggregates: ASTM C33, natural sand, fine.
5) Admixture: ASTM C618, fly-ash mineral.
6) Water: Comply with ASTM C94/C94M.
7) Strength: 100 to 200 psig at 28 days.

PART 3 EXECUTION

1. PIPED UTILITY DEMOLITION

   a. Refer to Section 024119 "Selective Demolition" for general demolition requirements and procedures.

   b. Disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.

      1) Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
      2) Piping to Be Abandoned in Place: Drain piping. Fill abandoned piping with flowable fill, and cap or plug piping with same or compatible piping material.
      3) Equipment to Be Removed: Disconnect and cap services and remove equipment.
      4) Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make operational.
      5) Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

   c. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

2. DIELECTRIC FITTING APPLICATIONS

   a. Dry Piping Systems: Connect piping of dissimilar metals with the following:

      1) NPS 2 and Smaller: Dielectric unions.
      2) NPS 2-1/2 to NPS 12): Dielectric flanges or dielectric flange kits.

   b. Wet Piping Systems: Connect piping of dissimilar metals with the following:

      1) NPS 2 (DN 50) and Smaller: Dielectric couplings or dielectric nipples
      2) NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Dielectric nipples.
      3) NPS 2-1/2 to NPS 8 (DN 65 to DN 200): Dielectric nipples[or dielectric flange kits.
      4) NPS 10 and NPS 12 (DN 250 and DN 300): Dielectric flange kits.

3. PIPING INSTALLATION

   a. Install piping according to the following requirements and utilities Sections specifying piping systems.

b. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.

c. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

d. Install piping to permit valve servicing.

e. Install piping at indicated slopes.

f. Install piping free of sags and bends.

g. Install fittings for changes in direction and branch connections.

h. Select system components with pressure rating equal to or greater than system operating pressure.

i. Sleeves are not required for core-drilled holes.

j. Permanent sleeves are not required for holes formed by removable PE sleeves.

k. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

1) Cut sleeves to length for mounting flush with both surfaces.

a) Exception: Extend sleeves installed in floors of equipment areas or other wet areas 2 inches above finished floor level.

2) Install sleeves in new walls and slabs as new walls and slabs are constructed.

a) PVC Pipe Sleeves: For pipes smaller than NPS 6
b) Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.

l. Verify final equipment locations for roughing-in.

m. Refer to equipment specifications in other Sections for roughing-in requirements.

4. PIPING JOINT CONSTRUCTION

a. Join pipe and fittings according to the following requirements and utilities Sections specifying piping systems.

b. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

c. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

d. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

   1) Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
   2) Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

e. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

f. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

g. Grooved Joints: Assemble joints with grooved-end pipe coupling with coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

h. Soldered Joints: Apply ASTM B813 water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B828 or CDA's "Copper Tube Handbook," using lead-free solder alloy (0.20 percent maximum lead content) complying with ASTM B32.

i. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

j. Pressure-Sealed Joints: Assemble joints for plain-end copper tube and mechanical pressure seal fitting with proprietary crimping tool to according to fitting manufacturer's written instructions.

k. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

   1) Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements.
   2) ABS Piping: Join according to ASTM D2235 and ASTM D2661 appendixes.
   3) CPVC Piping: Join according to ASTM D2846/D2846M Appendix.
   4) PVC Pressure Piping: Join schedule number ASTM D1785, PVC pipe and PVC socket fittings according to ASTM D2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D2855.
   5) PVC Nonpressure Piping: Join according to ASTM D2855.
   6) PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D3138 Appendix.

l. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D3139.

m. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D3212.

n. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D2657.

1) Plain-End PE Pipe and Fittings: Use butt fusion.
2) Plain-End PE Pipe and Socket Fittings: Use socket fusion.

o. Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

5. PIPING CONNECTIONS

a. Make connections according to the following, unless otherwise indicated:

1) Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2) Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3) Install dielectric fittings at connections of dissimilar metal pipes.

6. EQUIPMENT INSTALLATION

a. Install equipment level and plumb, unless otherwise indicated.

b. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.

c. Install equipment to allow right of way to piping systems installed at required slope.

7. PAINTING

a. Painting of piped utility systems, equipment, and components is specified in Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."

b. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

8. IDENTIFICATION

a. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.

1) Stenciled Markers: According to ASME A13.1.
2) Plastic markers, with application systems. Install on insulation segment if required for hot noninsulated piping.
3) Locate pipe markers on exposed piping according to the following:

a) Near each valve and control device.
b) Near each branch, excluding short takeoffs for equipment and terminal units. Mark each pipe at branch if flow pattern is not obvious.
c) Near locations where pipes pass through walls or floors or enter inaccessible enclosures.
d) At manholes and similar access points that permit view of concealed piping.
e) Near major equipment items and other points of origination and termination.

b. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of equipment.

1) Lettering Size: Minimum 1/4 inch high for name of unit if viewing distance is less than 24 inches, 1/2 inch high for distances up to 72 inches, and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
2) Text of Signs: Provide name of identified unit. Include text to distinguish among multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

c. Adjusting: Relocate identifying devices that become visually blocked by work of this or other Divisions.

9. CONCRETE BASES

a. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1) Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2) Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of base.
3) Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.

4) Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5) Install anchor bolts to elevations required for proper attachment to supported equipment.
6) Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7) Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Section 033000 "Cast-in-Place Concrete."

10. ERECTION OF METAL SUPPORTS AND ANCHORAGES

a. Refer to Section 055000 "Metal Fabrications" for structural steel.

b. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor piped utility materials and equipment.

c. Field Welding: Comply with AWS D1.1/D1.1M.

11. GROUTING

a. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.

b. Clean surfaces that will come into contact with grout.

c. Provide forms as required for placement of grout.

d. Avoid air entrapment during placement of grout.

e. Place grout, completely filling equipment bases.

f. Place grout on concrete bases and provide smooth bearing surface for equipment.

g. Place grout around anchors.

h. Cure placed grout.

END OF SECTION 330500

SECTION 32 91 13
SOIL PREPARATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes planting soils specified according to performance requirements of the mixes.

B. Related Requirements:
1. Section 329300 "Plants" for placing planting soil for plantings.

1.2 DEFINITIONS

A. AAPFCO: Association of American Plant Food Control Officials.

B. Backfill: The earth used to replace or the act of replacing earth in an excavation. This can be amended or unamended soil as indicated.

C. CEC: Cation exchange capacity.

D. Compost: The product resulting from the controlled biological decomposition of organic material that has been sanitized through the generation of heat and stabilized to the point that it is beneficial to plant growth.

E. Duff Layer: A surface layer of soil, typical of forested areas, that is composed of mostly decayed leaves, twigs, and detritus.

F. Imported Soil: Soil that is transported to Project site for use.

G. Manufactured Soil: Soil produced by blending soils, sand, stabilized organic soil amendments, and other materials to produce planting soil.

H. NAPT: North American Proficiency Testing Program. An SSSA program to assist soil-, plant-, and water-testing laboratories through interlaboratory sample exchanges and statistical evaluation of analytical data.

I. Organic Matter: The total of organic materials in soil exclusive of undecayed plant and animal tissues, their partial decomposition products, and the soil biomass; also called "humus" or "soil organic matter."

J. Planting Soil: Imported soil or manufactured soil that has been modified as specified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

K. RCRA Metals: Hazardous metals identified by the EPA under the Resource Conservation and Recovery Act.

L. SSSA: Soil Science Society of America.

M. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

N. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

O. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil"; but in disturbed areas such as urban environments, the surface soil can be subsoil.

P. USCC: U.S. Composting Council.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include recommendations for application and use.
2. Include test data substantiating that products comply with requirements.
3. Include sieve analyses for aggregate materials.
4. Material Certificates: For each type of imported soil and soil amendment and fertilizer before delivery to the site, according to the following:
   a. Manufacturer's qualified testing agency's certified analysis of standard products.
   b. Analysis of fertilizers, by a qualified testing agency, made according to AAPFCO methods for testing and labeling and according to AAPFCO's SUIP #25.
   c. Analysis of nonstandard materials, by a qualified testing agency, made according to SSSA methods, where applicable.

B. Samples: For each bulk-supplied material, 1-quart (1-L) volume of each in sealed containers labeled with content, source, and date obtained. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of composition, color, and texture.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For each testing agency.

B. Preconstruction Test Reports: For preconstruction soil analyses specified in "Preconstruction Testing" Article.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent, state-operated, or university-operated laboratory; experienced in soil science, soil testing, and plant nutrition; with the experience and capability to conduct the testing indicated; and that specializes in types of tests to be performed.
1. Laboratories: Subject to compliance with requirements, qualified independent soil testing services include, but are not limited to:

   a. Penn State College of Agricultural Sciences, Agricultural Analytical Services Lab
   111 Ag Analytical Services Lab, University Park, PA 16802
   Phone: 814-863-0841
   Email: aaslab@psu.edu
   www.agsci.psu.edu

   b. Rutgers Soil Testing Laboratory
   Rutgers, The State University of New Jersey

57 US Highway 1, New Brunswick, NJ 08901-8554
Phone: 848-932-9295
Email: soiltest@njaes.rutgers.edu
https://njaes.rutgers.edu/soil-testing-lab/

2. Multiple Laboratories: At Contractor's option, work may be divided among qualified testing laboratories specializing in physical testing, chemical testing, and fertility testing.

1.6 PRE-CONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction soil analyses on imported soil.
   1. Notify Landscape Architect at least seven (7) days in advance of the dates and times when laboratory samples will be taken.

B. Preconstruction Soil Analyses: For each unamended soil type, perform testing on soil samples and furnish soil analysis and a written report containing soil-amendment and fertilizer recommendations by a qualified testing agency performing the testing according to "Soil-Sampling Requirements" and "Testing Requirements" articles.
   1. Have testing agency identify and label samples and test reports according to sample collection and labeling requirements.

1.7 PRE-CONSTRUCTION SOIL-SAMPLING REQUIREMENTS

A. General: Extract soil samples according to requirements in this article.

B. Sample Collection and Labeling: Have samples taken and labeled by Contractor in presence of Landscape Architect under the direction of the testing agency.
   1. Number and Location of Samples: Minimum number of representative soil samples to be determined by testing agency for each soil to be used or amended for landscaping purposes.
   2. Procedures and Depth of Samples: To be determined by testing agency.
   3. Division of Samples: Split each sample into two, equal parts. Send half to the testing agency and half to Owner for its records.
   4. Labeling: Label each sample with the date, location keyed to a site plan or other location system, visible soil condition, and sampling depth.

1.8 PRE-CONSTRUCTION TESTING REQUIREMENTS

A. General: Perform tests on soil samples according to requirements in this article.

B. Physical Testing:
   1. Soil Texture: Soil-particle, size-distribution analysis by the following methods according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods":
      a. Sieving Method: Report sand-gradation percentages for very coarse, coarse, medium, fine, and very fine sand; and fragment-gradation (gravel) percentages for fine, medium, and coarse fragments; according to USDA sand and fragment sizes.
      b. Hydrometer Method: Report percentages of sand, silt, and clay.
   2. Bulk Density: Analysis according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."

3. Total Porosity: Calculate using particle density and bulk density according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
4. Water Retention: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
5. Saturated Hydraulic Conductivity: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods"; at 85 percent compaction according to ASTM D698 (Standard Proctor).

C. Chemical Testing:
1. CEC: Analysis by sodium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 3-Chemical Methods."
2. Clay Mineralogy: Analysis and estimated percentage of expandable clay minerals using CEC by ammonium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
3. Metals Hazardous to Human Health: Test for presence and quantities of RCRA metals including aluminum, arsenic, barium, copper, cadmium, chromium, cobalt, lead, lithium, and vanadium. If RCRA metals are present, include recommendations for corrective action.
4. Phytotoxicity: Test for plant-available concentrations of phytotoxic minerals including aluminum, arsenic, barium, cadmium, chlorides, chromium, cobalt, copper, lead, lithium, mercury, nickel, selenium, silver, sodium, strontium, tin, titanium, vanadium, and zinc.

D. Fertility Testing: Soil fertility analysis according to standard laboratory protocol of SSSA NAPT NEC-67, including the following:

1. Percentage of organic matter.
2. CEC, calcium percent of CEC, and magnesium percent of CEC.
3. Soil reaction (acidity/alkalinity pH value).
4. Buffered acidity or alkalinity.
5. Nitrogen ppm.
6. Phosphorous ppm.
7. Potassium ppm.
8. Manganese ppm.
9. Manganese-availability ppm.
10. Zinc ppm.
11. Zinc availability ppm.
12. Copper ppm.
13. Sodium ppm.
14. Soluble-salts ppm.
15. Presence and quantities of problem materials including salts and metals cited in the Standard protocol. If such problem materials are present, provide additional recommendations for corrective action.
16. Other deleterious materials, including their characteristics and content of each.

E. Organic-Matter Content: Analysis using loss-by-ignition method according to SSSA's "Methods of Soil Analysis - Part 3-Chemical Methods."

F. Recommendations: Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated to produce satisfactory planting soil suitable for healthy, viable plants indicated. Include, at a minimum, recommendations for nitrogen, phosphorous, and potassium fertilization, and for micronutrients.
1. Fertilizers and Soil Amendment Rates: State recommendations in weight per 1,000 sq. ft. for 6-inch depth of soil.

2. Soil Reaction: State the recommended liming rates for raising pH or sulfur for lowering pH according to the buffered acidity or buffered alkalinity in weight per 1000 sq. ft. for 6-inch depth of soil.

1.9 POST-CONSTRUCTION TESTING

A. Post-Construction Testing Service: Engage a qualified testing agency to perform post-construction analyses on amended planting bed soil with compost incorporated.
1. Notify Landscape Architect seven (7) days in advance of the dates and times when laboratory samples will be taken.

B. Post-Construction Soil Analyses: For each amended soil, perform testing on soil samples and furnish soil analysis and a written report by a qualified testing agency performing the testing according to "Soil-Sampling Requirements" and "Testing Requirements" articles.
1. Have testing agency identify and label samples and test reports according to sample collection and labeling requirements.

1.10 POST-CONSTRUCTION SOIL-SAMPLING REQUIREMENTS

A. General: Perform tests on soil samples according to the requirements in this article.

B. Fertility Testing:
1. Percentage of organic matter.
   a. Organic matter content must be 4% minimum.
2. CEC, calcium percent of CEC, and magnesium percent of CEC
3. Soil reaction (acidity / alkalinity pH value).
   a. pH levels must be between 5.5 and 6.5. Lower pH by using elemental sulfur product. Peat moss or copper sulfate may not be used to lower pH.
4. Buffered acidity or alkalinity.
5. Nitrogen ppm.
6. Phosphorus ppm.
7. Potassium ppm.
8. Manganese ppm.
9. Manganese-availability ppm.
10. Zinc ppm.
11. Zinc-availability ppm.
12. Copper ppm.
13. Sodium ppm.
14. Soluble-salts ppm.
   a. Soluble-salts measurement must be less or equal to 2 mmho/cm.
15. Presence and quantities of problem materials including salts and metals cited in the Standard protocol. If such problem materials are present, provide additional recommendations for corrective action.
16. Other deleterious materials, including their characteristics and content of each.
17. Percolation test to ensure adequate drainage and proper mixing of compost.

C. Recommendations: The analysis tests shall show recommendations for soil additives or fertilizers to correct soil mixes' deficiencies, as necessary.

D. Deficiencies: Nutrient deficiencies shall be corrected at time of installation.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and compliance with state and Federal laws if applicable.

B. Bulk Materials:
1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Do not move or handle materials when they are wet or frozen.
4. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

PART 2 - PRODUCTS

2.1 PLANTING SOILS SPECIFIED ACCORDING TO PERFORMANCE REQUIREMENTS

A. Planting Soil: Imported, naturally formed or manufactured soil from off-site sources consisting of fertile, friable, naturally fine sandy loam, (USDA classification for soil consisting of 10-20 percent clay, 30-50 percent silt and 50-70 percent fine sand, particle 0.10-0.25 mm.) pH range of 5.5 to 6.5, 4 percent organic material minimum, and with sufficient structure to give good tilth and aeration.
1. Sources: Take imported, unamended soil from sources that are naturally well-drained sites where topsoil occurs at least 4 inches deep, not from agricultural land, bogs, or marshes; and that do not contain undesirable organisms or disease-causing plant pathogens.
2. Soil shall not contain any noxious weeds or invasive plants, including, but not limited to, quackgrass, Johnsongrass, poison ivy, nutsedge, nimblewill, Canada thistle, bindweed, bentgrass, wild garlic, ground ivy, perennial sorrel, and bromegrass.
3. Clean Planting Soil shall not include any of the following:
   a. Unacceptable Materials: Concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.
   b. Unsuitable Materials: Stones, roots, plants, sod, clay lumps, and pockets of coarse sand 1-inch or larger.
4. Amend imported soil with materials specified in other articles of this Section to become planting soil complying with the following requirements:
   a. Particle Size Distribution by Separates:
      - Fine Sand: 50% to 70% percent by dry weight.
      - Silt: 30% to 50% percent by dry weight.
      - Clay: 10% to 20% percent by dry weight.
   b. Percentage of Organic Matter: Minimum 4% by volume.
   c. Soil Reaction: pH of 5.5 to 6.5.
   d. CEC of Clay Fraction: Maximum 15 meq/100 mL at pH of 7.0.
   e. Soluble-Salt Content: 5 to 1- dS/m measured by electrical conductivity.
   f. RCRA Metals: Below maximum limits established by the EPA.
   g. Phytotoxicity: Below phytotoxicity limits established by SSSA.
5. Acceptable ranges for base saturation percentages are:

Element	Desired % Range	Ideal %
Ca	60-70%	68%
Mg	10-20%	12%
K	2-5%	5%
Na	0.5-3%	0.75%
Other bases (variable)	2-4%	3.75%
Exchangeable Hydrogen	10-15%	10.5%

B. Topsoil: ASTM D5268, fertile, friable, naturally fine sandy loam (USDA classification for soil consisting of 10-20% clay, 30-50% silt, and 50-70% fine sand, particle 0.1-0.25mm), pH range of 5.5 to 6.5, 4% organic material minimum.

1. Topsoil Source: Reuse surface soil stockpiled on-site. Do not stockpile topsoil more than 6-feet high. Verify stability of stockpiled surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stone, clay lumps, and other extraneous materials harmful to plant growth.
2. Supplement with imported topsoil from off-site sources when quantities are insufficient. Obtain topsoil displaced from naturally, well-drained construction or mining site where topsoil occurs at least 4-inches deep; do not obtain from agricultural land, bogs, or marshes.

C. Unacceptable Properties

1. Clean soil of the following:
   a. Unacceptable Materials: concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, litter or other extraneous materials that are harmful to plant growth.
   b. Unsuitable Materials: stones 1-inche or larger in any dimension, noxious seeds, sticks, brush, roots, plants, sod, clay lumps, and pockets of co

D. FERTILIZER

1. Should nutrient analysis suggest that the loam or clay loam need additional nutrients, it shall be amended in accordance with Soil Analysis **and for the specific plants specified on the Plant Schedule**.

E. SULFUR

1. Sulfur shall be a commercial granular, 96% pure sulfur, with material and analysis appearing on the labeled container.
2. Sulfur used to lower pH shall be a ferrous sulfate formulation.
3. Application rates shall be dependent on soil test results.

F. LIME

1. Agricultural lime containing a minimum of 85% carbonates.
2. Application rates shall be dependent on soil test results.

G. HYDROGEL

1. Hydrogel shall be a coated potassium propenoate-propenamide copolymer (Gelscape® Hydrogel Tackifier) as manufactured by Amereq, Inc. 800-832-8788.

H. WATER

1. The installing contractor shall be responsible to furnish his own supply of water (if needed) free of impurities, to the site.

2.2 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
   1. Class: T, with a minimum of 99 percent passing through a No. 8 sieve and a minimum of 75 percent passing through a No. 60 sieve.

B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent elemental sulfur, with a minimum of 99 percent passing through a No. 6 sieve and a maximum of 10 percent passing through a No. 40 sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Perlite: Horticultural perlite, soil amendment grade.

E. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through a No. 50 sieve.

F. Sand: Clean, washed, natural or manufactured, free of toxic materials, and according to ASTM C33/C33M.

G. Diatomaceous Earth: Horticultural diatomaceous earth, soil amendment grade.

2.3 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter produced by composting feedstock, and bearing USCC's "Seal of Testing Assurance," and as follows:
   1. Feedstock: Compost may be derived from: agricultural, food, or industrial residuals; biosolids (treated sewage sludge); yard trimmings; source-separated or mixed solid waste. The product shall contain no substances toxic to plants and shall be reasonably free (< 1% by dry weight) of man-made foreign matter. The compost will possess no objectionable odors and shall not resemble the raw material from which it was derived. Do not use compost that has received the addition of liming agents or ash by-products. The product shall be certified through the U.S. Composting Council's (USCC) Seal of Testing Assurance (STA) Program.
   2. Reaction: pH of 5.5 to 8
   3. Soluble-Salt Concentration: Less than 5-10 dS/m.
   4. Moisture Content: 35 to 55 percent by weight.
   5. Particle Size: 100 percent passing through a 1/2-inch sieve.
   6. **The compost supplier shall test all compost products within 90 Calendar Days prior to application.** Samples shall be collected using the Seal of Testing Assurance (STA) sample collection protocol. The sample collection protocol can be obtained from the U.S. Composting Council, 4250 Veterans Memorial Highway, Suite 275, Holbrook, NY 11741 Phone: (631) 737-4931, www.compostingcouncil.org.
      a. The sample shall be sent to an independent STA Program approved laboratory. The compost supplier shall pay for the test. A copy of the approved independent STA Program laboratory test report shall be submitted to the Landscape Architect prior to initial application of the compost. Seven days prior to application, the Contractor shall submit a sample of each type of compost to be used on the project to the Landscape Architect.
   7. Compost not conforming to the above requirements or taken from a source other than those tested and accepted shall be immediately removed from the project and replaced at no cost to the Owner.
   8. The Contractor shall submit the following information to the Landscape Architect for approval:

a. The supplier shall verify in writing and provide lab analyses that the Materials comply with the processes, testing, and standards specified in these Specifications. An independent STA Program certified laboratory shall perform the analysis.
b. A copy of the producer's STA certification as issued by the U.S. Composting Council.

2.4 FERTILIZERS

A. As required by soil analysis and recommendations.

B. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified testing agency.

PART 3 - EXECUTION

3.1 GENERAL

A. Place planting soil and fertilizers according to requirements in other Specification Sections.

B. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in planting soil.

C. Proceed with placement only after unsatisfactory conditions have been corrected.

D. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff of airborne dust to adjacent properties and walkways.

3.2 PLACING AND MIXING PLANTING SOIL OVER EXPOSED SUBGRADE

A. General: Apply and mix unamended soil with amendments on-site to produce required planting soil, or apply manufactured soil on site in its final, blended condition. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.

B. Subgrade Preparation: Till subgrade to a minimum depth of 4 inches. Remove stones larger than 1-1/2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
1. Apply, add soil amendments, and mix approximately half the thickness of unamended soil over prepared, loosened subgrade according to "Mixing" Paragraph below. Mix thoroughly into top 2 inches of subgrade. Spread remainder of planting soil.

C. Mixing: If amending soil on-site, spread unamended soil to total depth indicated on Drawings, but not less than required to meet finish grades after mixing with amendments and natural settlement. Do not spread if soil or subgrade is frozen, muddy, or excessively wet.
1. Amendments: Apply soil amendments and fertilizer, if required, evenly on surface, and thoroughly blend them with unamended soil to produce planting soil.
a. Mix lime and sulfur with dry soil before mixing fertilizer.

b. Mix fertilizer with planting soil no more than seven days before planting.

2. Lifts: Apply and mix unamended soil and amendments in lifts not exceeding 8 inches in loose depth for material compacted by compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

D. Compaction: Compact each blended lift of planting soil to 75 to 82 percent of maximum Standard Proctor density according to ASTM D698.

E. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.3 PROTECTION

A. Protection Zone: Identify protection zones as indicated on Drawings.

B. Protect areas of in-place soil from additional compaction, disturbance, and contamination. Prohibit the following practices within these areas except as required to perform planting operations:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Vehicle traffic.
4. Foot traffic.
5. Erection of sheds or structures.
6. Impoundment of water.
7. Excavation or other digging unless otherwise indicated.

C. If planting soil or subgrade is over-compacted, disturbed, or contaminated by foreign or deleterious materials or liquids, remove the planting soil and contamination; restore the subgrade as directed by Landscape Architect and replace contaminated planting soil with new planting soil.

3.4 CLEANING

A. Protect areas adjacent to planting-soil preparation and placement areas from contamination. Keep adjacent paving and construction clean and work area in an orderly condition.

B. Remove surplus soil and waste material including excess subsoil, unsuitable materials, trash, and debris and legally dispose of them off Owner's property unless otherwise indicated.

1. Legally dispose of excess subsoil and unsuitable materials off-site.

END OF SECTION

SECTION 32 93 00
PLANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Trees (Canopy and Understory).
2. Shrubs.
3. Herbaceous Plants (Ornamental Grasses, Perennials, and Groundcovers).
4. Fertilizers
5. Mulches.
6. Tree Watering Bags.
7. Landscape edgings.

B. Related Requirements:
1. Section 329113 "Soil Preparation" for information regarding planting soils.

1.2 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with a ball size not less than sizes indicated, wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.

C. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.

D. Finish Grade: Elevation of finished surface of planting soil.

E. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

F. Planting Area: Areas to be planted.

G. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See Section 329113 "Soil Preparation" for drawing designations for planting soils.

H. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.

I. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.

J. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.

K. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.3 COORDINATION

A. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.
   1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.
   2. Contractor shall provide confirmed Plant Schedule to Landscape Architect a minimum of six (6) weeks prior to anticipated Plant Installation and shall coordinate with Landscape Architect for Tree Tagging.

B. Samples for Verification: For each of the following:

   1. Plant Material: Bill of sale indicating full scientific name, quantity, plant size, and name of growing nursery for all plant material.
   2. Organic Compost Mulch: 1-quart (1-L) volume of each organic mulch required; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of color, texture, and organic makeup.

C. Planting & Installation Schedule: Submit proposed planting and installation schedule, indicating dates for completion of work items, as coordinated with Construction Manager, plant tagging, soil testing, digging of woody plants, and installation of each type of landscape work during normal seasons for such work in area of site.

D. Correlate Plant & Installation Schedule with specified maintenance periods to provide maintenance from date of Substantial Completion. Once accepted, revise dates only as approved in writing, after documentation of reasons for delays.
   1. Submit letter notifying Owner and Landscape Architect of completion of planting work and requesting inspection to determine acceptability for Substantial Completion and beginning of Warranty Period.
   2. Submit letter to Owner and Landscape Architect requesting a final inspection of planting work for Final Acceptance at end of Warranty Period.

E. Plant Maintenance Schedule: Submit proposed plant maintenance schedule, indicating frequency of maintenance visits and scheduled maintenance activities to occur during visits.
   1. Plant maintenance shall include watering of plants. Loss of plants due to inadequate watering will be considered negligence of maintenance services and will require plant replacement at no cost to Owner.
   2. A one-year watering plan shall be submitted as part of Plant Maintenance Schedule.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.

B. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:
   1. Manufacturer's certified analysis of standard products.
   2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.

C. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before expiration of required maintenance periods.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of plants.
   1. Professional Membership: Installer shall be a member in good standing of either the National Association of Landscape Professionals or AmericanHort.
   2. Experience: Engage an experienced Installer who has completed planting work similar in material, design, and extent to that indicated for this Project and with a record of successful plant establishment for a minimum of three (3) years.
   3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
   4. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the National Association of Landscape Professionals:
      a. Landscape Industry Certified Technician - Exterior.
      b. Landscape Industry Certified Horticultural Technician.

B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.

C. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.
   1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container-grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches above the root flare for trees up to 4-inch caliper size, and 12 inches above the root flare for larger sizes.
   2. Other Plants: Measure with stems, petioles, and foliage in their normal position.

D. Plant Material Observation: Landscape Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Landscape Architect may also observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and may reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.
   1. Notify Landscape Architect of sources of planting materials at least seven (7) days in advance of delivery to site.

E. Substitutions: Substitutions will only be considered after review of plant availability with Landscape Architect. Submit request for substitutions in writing to Landscape Architect. **Substitutions will only be accepted with written approval by Landscape Architect.**

1.8 DELIVERY, STORAGE, AND HANDLING

A. Landscape Architect shall accompany Contractor to nursery to select and tag Trees. Landscape Architect may choose to select and tag Shrubs.

B. Landscape Architect shall select plants for proper visual formation. Contractor shall inspect selected plants for disease and other requirements of Contract Documents. **Prior to nursery trip, Contractor shall have pre-selected Nursery(s) to ascertain the sufficient plants in size and species required and provided the confirmed Plant Schedule to Landscape Architect.**

C. The Landscape Architect shall tag all trees and at least five (5) shrubs of each species as a representative sample. **Trees delivered to the Project site without tags, and shrubs that do not equally match the quality of tagged samples, shall be rejected.**

D. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws if applicable.

E. Bulk Materials:
1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk materials with appropriate certificates.

F. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.

G. Handle planting stock by root ball.

H. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F until planting.

I. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.
1. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.

J. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.

K. Deliver plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.
1. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
2. Do not remove container-grown stock from containers before time of planting.
3. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly wet condition.

L. All plant material must have labels showing botanical name on each individual plant. Plants without labels will be rejected from the Project Site.

M. Notify the Landscape Architect at least three (3) business days in advance of start of Work.

N. The Landscape Architect reserves the right to reject plant materials not meeting the above requirements.

1.9 FIELD CONDITIONS

A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.

B. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.

1. Spring Planting: March 15 – June 15
2. Fall Planting: September 1 – November 15
3. Planting outside of designated timeframes above may only occur with written approval from Landscape Architect.
4. Planting between June 16 to August 31 is not permitted.

C. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

1.10 WARRANTY

A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.
1. Failures include, but are not limited to, the following:
   a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner.
   b. Structural failures including plantings falling or blowing over.
   c. Faulty performance of tree stabilization and edgings.

2. Warranty Periods: From date of Substantial Completion.
   a. Trees, Shrubs, Vines, and Ornamental Grasses: Twelve (12) months.
   b. Ground Covers, Biennials, Perennials, and Other Plants: Twelve (12) months.

3. Include the following remedial actions as a minimum:
   a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
   b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
   c. A limit of one replacement of each plant is required except for losses or replacements due to failure to comply with requirements.
   d. Provide extended warranty for period equal to original warranty period, for replaced plant material.

PART 2 - PRODUCTS

2.1 NURSERIES

A. Nurseries shall be members of the American Association of Nurserymen and Pennsylvania Landscape and Nurserymen's Association, or equivalent State organization(s).

B. Nurseries shall be within same plant hardiness zone and having similar climate conditions as Project Site. Zone shall be as defined on United States Department of Agriculture Plant Hardiness Zone Map.

2.2 PLANT MATERIAL

A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant List, Plant Schedule, or Plant Legend indicated on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch in diameter; or with stem girdling roots are unacceptable.
2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.

B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.

C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which begins at root flare according to ANSI Z60.1. Root flare shall be visible before planting.

D. Labeling: Label each plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant.

E. If formal arrangements or consecutive order of plants is indicated on Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.

2.3 FERTILIZERS

A. Feeder Packs: Organic, biodegradeable packs containing a measured dose of fertilizer (4-2-2), mycorrhizae, biochar, azomite, and micronized oyster shell (5% calcium and 1% Sulphur).
1. *Fuhgeddaboudit!* Root Zone Feeder Packs, manufactured by Organic Mechanics Soil Company, LLC
P.O. Box 272, Modena, PA 19358
Phone: 610-380-4598
www.organicmechanicsoil.com

2.4 MULCHES

A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of the following:
1. Type: Triple-Shredded hardwood bark.
2. Size Range: 3-inch maximum, 1/2-inch minimum.
3. Color: Natural and undyed.

B. Leaf Litter: Chopped or shredded leaves, free of weeds, seeds, loam, sand, clay, and other foreign substances. Acquire leaf litter locally from a source approved by Landscape Architect.

2.5 TREE-STABILIZATION MATERIALS

A. Trunk-Stabilization Materials:

1. Upright and Guy Stakes: Rough-sawn, sound, new hardwood, free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal (38-by-38-mm actual) by length indicated, pointed at one end.
2. Flexible Ties: Wide rubber or elastic bands or straps of length required to reach stakes.
3. Guys and Tie Wires: ASTM A641/A641M, Class 1, galvanized-steel wire, two-strand, twisted, 0.106 inch (2.7 mm) in diameter.

TREE-WATERING DEVICES

A. Slow-Release Watering Bags: Standard product manufactured for drip irrigation of plants and emptying its water contents over an extended time period; manufactured from UV-light-stabilized nylon-reinforced polyethylene sheet, PVC, or HDPE plastic. Obtain from source below or approved equal.
1. Treegator Original, manufactured by Spectrum Products, Inc.
153 Mosswood Boulevard, Youngsville, NC 27596
Phone: 1-866-873-3428
www.treegator.com

2.7 MISCELLANEOUS PRODUCTS

A. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.

B. Burlap: Non-synthetic, biodegradable.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive plants, with Installer present, for compliance with requirements and conditions affecting installation and performance of the Work.
1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Verify that plants and vehicles loaded with plants can travel to planting locations with adequate overhead clearance.
3. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
4. Uniformly moisten excessively dry soil that is not workable or which is dusty.

B. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Landscape Architect and replace with new planting soil.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Landscape Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.

D. Lay out plants at locations directed by Landscape Architect. Stake locations of individual trees and shrubs and outline areas for multiple plantings.

3.3 PLANTING AREA ESTABLISHMENT

A. General: Prepare planting area for soil placement and mix planting soil according to Section 329113 "Soil Preparation."

B. Placing Planting Soil: Place and mix planting soil in-place over exposed subgrade.

C. Before planting, obtain Landscape Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 EXCAVATION FOR TREES AND SHRUBS

A. Planting Pits and Trenches: Excavate circular planting pits.
1. Excavate planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are unacceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.
2. Excavate approximately three times as wide as ball diameter for balled and burlapped and container-grown stock.
3. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
4. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
5. Maintain angles of repose of adjacent materials to ensure stability. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
6. Maintain supervision of excavations during working hours.
7. Keep excavations covered or otherwise protected after working hours or when unattended by Installer's personnel.

B. Backfill Soil: Subsoil and topsoil removed from excavations may be used as backfill soil unless otherwise indicated.

C. Obstructions: Notify Landscape Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

1. Hardpan Layer: Drill 6-inch diameter holes, 24 inches apart, into free-draining strata or to a depth of 10 feet, whichever is less, and backfill with free-draining material.

D. Drainage: Notify Landscape Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.

E. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

3.5 TREE AND SHRUB PLANTING

A. Inspection: At time of planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.

B. Roots: Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.

C. Balled and Burlapped Stock: Set each plant plumb and in center of planting pit or trench with top of root ball at same elevation relative to ground level as in the nursery.

1. Backfill: Approved planting soil.
2. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
4. Place fertilizer feeder packs equally distributed around each planting pit when pit is approximately one-half filled. Place packs beside the root ball per manufacturer's instructions.

    a. Quantity: Three (3) per canopy and understory tree.

5. Continue backfilling process. Water again after placing and tamping final layer of soil.

D. Container-Grown Stock: Set each plant plumb and in center of planting pit or trench with root ball level with adjacent finish grades of planting soil.

1. Backfill: Approved planting soil.
2. Carefully remove root ball from container without damaging root ball or plant.
3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
4. Place fertilizer feeding packs equally distributed around each planting pit when pit is approximately one-half filled. Place packs beside the root ball per manufacturer's instructions.

    a. Quantity: One (1) per shrub.

5. Continue backfilling process. Water again after placing and tamping final layer of soil.

E. Slopes: When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

3.6 TREE AND SHRUB PRUNING

A. Remove only dead, dying, or broken branches. Do not prune for shape.

B. Prune, thin, and shape trees and shrubs as directed by Landscape Architect.

C. Prune, thin, and shape trees and shrubs according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Landscape Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.

D. Do not apply pruning paint to wounds.

3.7 TREE STABILIZATION

A. Trunk Stabilization by Upright Staking and Tying: Install trunk stabilization as follows unless otherwise indicated:

1. Upright Staking and Tying:
   a. Stake trees of 2- through 5-inch (50- through 125-mm) caliper.
   b. Stake trees of less than 2-inch (50-mm) caliper only as required to prevent wind tip out.
   c. Use a minimum of two stakes of length required to penetrate at least 18 inches (450 mm) below bottom of backfilled excavation and to extend at least one-third of trunk height above grade. Set vertical stakes and space to avoid penetrating root balls or root masses.
   d. Stake trees with two stakes for trees up to 12 feet (3.6 m) high and 2-1/2 inches (63 mm) or less in caliper; three stakes for trees less than 14 feet (4.2 m) high and up to 4 inches (100 mm) in caliper. Space stakes equally around trees.

2. Support trees with bands of flexible ties at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.

HERBACEOUS PLANT PLANTING

A. Set out and space ground cover and plants other than trees and shrubs as indicated on Drawings in even rows with triangular spacing.

B. Use approved planting soil for backfill.

C. Dig holes large enough to allow spreading of roots.

D. For rooted cutting plants supplied in flats, plant each in a manner that minimally disturbs the root system but to a depth not less than two nodes.

E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.9 PLANTING AREA MULCHING

A. Mulch backfilled surfaces of planting areas and other areas indicated.
   1. Trees in Turf Areas: Apply organic mulch ring of 1-1/2" thick layer of leaf litter, followed by 1-1/2" thick layer of triple-shredded hardwood mulch on top of leaf litter layer, with 18-inch radius around trunks or stems. Do not place mulch within 3 inches of trunks or stems.
   2. Organic Mulch in Planting Areas: Apply 1-1/2" thick layer of leaf litter, followed by 1-1/2" thick layer of triple-shredded hardwood mulch on top of leaf litter layer, over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 3 inches of trunks or stems.

3.10 INSTALLATION OF EDGING

A. Shovel-Cut Edging: Separate mulched areas from turf areas with a 45-degree, 4- to 6-inch-deep, shovel-cut edge as indicated on Drawings.

B. Gravel Mow-Strip Installation:

   1. Excavate for gravel strip as indicated on Drawings.
   2. Compact subgrade uniformly beneath gravel strip.
   3. Install steel edging, delineating the edge of gravel mow-strip.
   4. Install weed-control barrier before mulching, covering area of mow strip, and overlapping and pinning edges of barrier at least 6 inches and according to manufacturer's written instructions.
   5. Place indicated thickness of gravel, fully covering weed barrier.
   6. Rake gravel to a uniform surface level with adjacent finish grades.

3.11 INSTALLATION OF TREE WATERING BAGS

A. Provide one watering bag for each tree.

B. Place watering bag on top of the mulch at base of tree stem and fill with water according to manufacturer's written instructions.

3.12 PLANT MAINTENANCE

A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings.

B. Fill in, as necessary, soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.

C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices when possible to minimize use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

D. Plant maintenance shall include watering of plants. Loss of plants due to inadequate watering will be considered negligence of maintenance services and will require plant replacement at no cost to Owner. A one-year watering plan shall be submitted as part of Plant Submittals.

E. Fertilize trees approximately one year after installation between October and December, or between February and April. Unless otherwise indicated by soil test results, apply at a rate of 2 pounds of actual nitrogen per 1,000

square feet. Make insertion points approximately 2'-6" apart, at a depth of 6 inches. Apply fertilizer in the ball and backfill area, and to approximately 1 foot outside of the planting hole.

3.13 REPAIR AND REPLACEMENT

A. General: Repair or replace existing or new trees and other plants that are damaged by construction operations, in a manner approved by Landscape Architect.
   1. Submit details of proposed pruning and repairs.
   2. Perform repairs of damaged trunks, branches, and roots within 24 hours, if approved.
   3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Landscape Architect.

B. Remove and replace trees that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Landscape Architect determines are incapable of restoring to normal growth pattern.
   1. Provide new trees of same size as those being replaced for each tree.
   2. Species of Replacement Trees: Species selected by Landscape Architect.

3.14 CLEANING AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

C. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

D. After installation and before Substantial Completion, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

E. At time of Substantial Completion, verify that tree-watering devices are in good working order and leave them in place. Replace improperly functioning devices.

3.15 MAINTENANCE SERVICE

A. Maintenance Service for Trees and Shrubs: Provide maintenance by skilled employees of landscape Installer. Maintain as required in "Plant Maintenance" Article. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below:
   1. Maintenance Period: 12 months from date of Substantial Completion.

B. Maintenance Service for Ground Cover and Other Plants: Provide maintenance by skilled employees of landscape Installer. Maintain as required in "Plant Maintenance" Article. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below:
   1. Maintenance Period: 12 months from date of Substantial Completion.

3.16 FINAL INSPECTION

A. Inspection to determine completion and acceptance of planted areas will be made by the Landscape Architect, upon Contractor's request. Provide notification at least ten (10) business days before requested inspection date. Inspection comments will be submitted to the Contractor in writing.

B. Planted areas will be accepted provided all requirements, including the maintenance period have been complied with and plant materials are alive and in a healthy, vigorous condition.

C. Upon acceptance of Work, the Owner will assume plant maintenance and the plant material Warranty period will begin.

D. An additional inspection will be made near the end of the Warranty period to determine if plant materials need to be replaced. Plants shall be in a health, vigorous growing state and free of disease and insects.

END OF SECTION